

---

**“ASSESSMENT OF VIDEO BASED EDUCATIONAL  
INTERVENTION ON KNOWLEDGE, ATTITUDE  
AND PRACTICES TOWARDS CLIMATE CHANGE  
AMONG UNDERGRADUATE COLLEGE STUDENTS  
OF BELAGAVI”**

---

**Submitted by  
(REG. NO. BD0122006)**

**Dissertation**

*Submitted to  
KAHER, Belagavi, Karnataka,  
In partial fulfilment of the requirements for the degree of*

**M. D. (Doctor of Medicine)  
In  
COMMUNITY MEDICINE**

**DEPARTMENT OF COMMUNITY MEDICINE,  
JAWAHARLAL NEHRU MEDICAL COLLEGE, KAHER,  
BELAGAVI, KARNATAKA, INDIA – 590010**

---

**AUGUST 2025 / SEPTEMBER 2025**


---

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,**

**BELAGAVI**

**Endorsement by the HOD & Principal/Head of the  
Institution**


This is to certify that the dissertation entitled "ASSESSMENT OF VIDEO  
BASED EDUCATIONAL INTERVENTION ON KNOWLEDGE,  
ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG  
UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI" is a bona fide  
research work done by the candidate REG. NO. BD0122006

*for*  
  
**Dr. GIRIJA J MAHANTSHETTI MD**  
Professor and Head,  
Department of Community Medicine,  
J. N. Medical College, KAHER,  
Belagavi - 590010  
Karnataka, India

Place: Belagavi

Date: 18.03.2025

**PROFESSOR & HEAD**  
**Dept. of Community Medicine**  
**J. N. Medical College, Belagavi**

  
**Dr. (Mrs.) N. S. MAHANTASHETTI MD**  
Principal,  
J. N. Medical College, KAHER,  
Belagavi - 590010  
Karnataka, India

Place: Belagavi

Date: 18.03.2025

## UNDERTAKING

I, **Reg. No. BD0122006** hereby declare that the information and the data mentioned in my dissertation titled “**ASSESSMENT OF VIDEO BASED EDUCATIONAL INTERVENTION ON KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI**” belongs to me and is original.

I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author’s work as one’s own, as by not crediting the original author.
- A piece of writing or other work reflecting such unauthorized use or imitation.
- The deliberate or reckless representation of another’s words, thoughts or ideas as one’s own without attribution in connection with submission of academic work, whether graded or otherwise.

I hereby declare that the dissertation prepared by me is original one and does not involve plagiarism anywhere. In case at a later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the institution is liberty to take any disciplinary action against me including cancellation of dissertation or any other penalties imposed by the University.

**Date: 25-03-2025**

**Place: Belagavi**



**(Reg No: BD0122006)**

## PLAGIARISM ACCEPTED LETTER



# JAWAHARLAL NEHRU MEDICAL COLLEGE



(A constituent unit of KLE Academy of Higher Education & Research Deemed-to-be-University)

(Recognized by National Medical Commission, New Delhi)

Accredited 'A+' Grade by NAAC (3<sup>rd</sup> Cycle)

Placed in Category 'A' by MoE (GoI)

Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

☎ 0831 - 2471350

☎ 0831 - 2470759

🌐 www.jnmc.edu

✉ principal@jnmc.edu

Ref No: MDC/PG/

Date: 06-03-2025

### "ACCEPTANCE LETTER"

The softcopy of thesis entitled: "ASSESSMENT OF VIDEO BASED EDUCATIONAL INTERVENTION ON KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI" has been submitted for anti-plagiarism check through Turnitin software. The scan has been carried out and the scanned output reveals a match percentage of 01% which is within the acceptable limits of 10% as per the guidelines given by UGC.

*Shivaswamy*  
Guide.



*N.S. Mahantashetti*  
Dr. (Mrs.) N.S. Mahantashetti,  
Chairperson-Antiplagiarism Committee &  
Principal,  
J. N. Medical College, Belagavi.

To,  
Reg. No. BD0122006  
Postgraduate Student,  
2022-23 Batch,  
Department of Community Medicine  
J. N. Medical College, Belagavi.

## ETHICAL CLEARANCE



K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH  
(Deemed – to- be- University)

Accredited 'A+' Grade by NAAC in (3<sup>rd</sup> Cycle) Placed in Category 'A' by MHRD (GoI)

**JNMC INSTITUTIONAL ETHICS COMMITTEE**  
**JAWAHARLAL NEHRU MEDICAL COLLEGE,**  
**NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)**

Website: <http://www.jnmc.edu>  
E-Mail : [dome@jnmc.edu](mailto:dome@jnmc.edu)

Phone: (+ 91-(0)831 Office : 2472550  
Principal: 2471701  
Fax No. +91 (0)831 – 2470759

Ref No.MDC/JNMCIEC/ 43

Date: 31/03/2023

To,  
BD0122006  
PG Student in Community Medicine  
J. N. Medical College,  
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled "ASSESSMENT OF VIDEO BASED EDUCATIONAL INTERVENTION ON KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI", is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

**(Dr. Smrita Sonoli)**  
Member Secretary  
JNMC Institutional Ethics Committee  
J.N.Medical College, Belagavi.

**(Dr. Harsha Hegde)**  
Chairman,  
JNMC Institutional Ethics Committee  
J.N.Medical College, Belagav

## **LIST OF ABBREVIATIONS USED**

<b>S. No.</b>	<b>Abbreviations</b>	<b>Expansion of the Abbreviations</b>
1.	WMO	World Meteorological Organization
2.	GHG	Greenhouse Gases
3.	CO <sub>2</sub>	Carbon Dioxide
4.	USD	United States Dollar
5.	IPCC	Intergovernmental Panel on Climate Change
6.	UNDP	United Nations Development Programme
7.	UNESCO	United Nations Educational, Scientific and Cultural Organization
8.	WHO	World Health Organization
9.	UNEP	United Nations Environment Programme
10.	AYP	Adolescent and Young People
11.	KAHER	KLE Academy of Higher Education and Research
12.	KLS	Karnatak Law Society
13.	IEC	Institutional Ethics Committee
14.	JNMC	Jawaharlal Nehru Medical College
15.	PHC	Primary Health Centre
16.	UHC	Urban Health Centre
17.	SPSS	Statistical Package for Social Sciences
18.	ANOVA	Analysis of Variance
19.	INR	Indian Rupee
20.	SES	Socio-Economic Status
21.	CPI	Consumer Price Index
22.	CPI-IW	CPI for Industrial Workers

23.	MF	Multiplication Factor
24.	LCD	Liquid Crystal Display
25.	PCI	Per Capita Income
26.	CASP	Critical Appraisal Skills Programme
27.	MMAT	Mixed Methods Appraisal Tool
28.	IQR	Interquartile Range
29.	UGC	University Grants Commission
30.	NGO	Non-Governmental Organization
31.	NAAC	National Assessment and Accreditation Council
32.	NIRF	National Institute Ranking Framework
33.	%	Percentage
34.	=	Equal to
35.	>	Greater than
36.	<	Lesser than
37.	$\geq$	Greater than or Equal to
38.	$\leq$	Lesser than or Equal to

## **ABSTRACT**

**Background:** Climate change poses significant environmental, social, and health challenges worldwide. Addressing climate change through education is crucial to fostering awareness and proactive behaviours. Video-based educational interventions have emerged as effective tools for enhancing climate literacy. This study evaluates the effectiveness of a video-based educational intervention on the knowledge, attitudes, and practices (KAP) towards climate change among undergraduate college students in Belagavi, Karnataka, India.

**Objective:** To assess the effect of a video-based educational intervention on the knowledge, attitudes, and practices of undergraduate college students towards climate change.

**Methods:** A before-after (pre-post) interventional study design was employed across four randomly selected undergraduate colleges in Belagavi city. A total of 320 first-year undergraduate students were recruited through proportionate sampling. The intervention consisted of a 16-minute educational video on climate change followed by an interactive session and the distribution of informational handouts. Pre- and post-intervention data were collected using a structured questionnaire covering socio-demographic information, and KAP domains. Descriptive and inferential statistics, including paired t-tests and chi-square tests, were used to analyse the data. Effect sizes were calculated using Cohen's d and Cohen's w to evaluate the intervention's impact.

**Results:** The mean knowledge score significantly increased from  $13.45 \pm 1.08$  (pre-test) to  $17.04 \pm 1.44$  (post-test) ( $p < 0.001$ ), indicating a large effect size (Cohen's  $d = 2.82$ ). Notable improvements were observed in climate change awareness (from 90.94% to 98.75%), and understanding of greenhouse gases (from 91.88% to 100%). Positive attitudes towards the inclusion of climate change education in curricula increased from 57.81% to 100% (Cohen's  $w = 0.61$ ). Negative attitudes, such as the belief that individual actions are ineffective, decreased

significantly (Cohen's  $w = 0.32$  to  $0.55$ ). Climate-friendly practices, including reducing plastic use (97.19% to 78.13%) and adopting energy-saving measures (61.56% to 81.56%), showed substantial improvements post-intervention.

**Conclusion:** The video-based educational intervention significantly improved knowledge, attitudes, and practices regarding climate change among undergraduate students. Integrating similar multimedia tools in educational settings can effectively enhance climate literacy and promote sustainable behaviours. Future research should explore long-term behavioural changes and expand interventions to diverse educational contexts.

## TABLE OF CONTENTS

<b>S. NO.</b>	<b>CONTENTS</b>	<b>PAGE NO.</b>
<b>1.</b>	<b>INTRODUCTION</b>	<b>1-4</b>
<b>2.</b>	<b>OBJECTIVES</b>	<b>5</b>
<b>3.</b>	<b>REVIEW OF LITERATURE</b>	<b>6-14</b>
<b>4.</b>	<b>METHODOLOGY</b>	<b>15-29</b>
<b>5.</b>	<b>RESULTS</b>	<b>30-69</b>
<b>6.</b>	<b>DISCUSSION</b>	<b>70-84</b>
<b>7.</b>	<b>CONCLUSION</b>	<b>85-87</b>
<b>8.</b>	<b>RECOMMENDATIONS</b>	<b>88-89</b>
<b>9.</b>	<b>STRENGTHS</b>	<b>90</b>
<b>10.</b>	<b>LIMITATIONS</b>	<b>91</b>
<b>11.</b>	<b>SUMMARY</b>	<b>92-95</b>
<b>12.</b>	<b>REFERENCES</b>	<b>96-102</b>
<b>13.</b>	<b>ANNEXURES (I-VII)</b>	<b>103-127</b>

## LIST OF TABLES

<b>S. NO.</b>	<b>TABLES</b>	<b>PAGE NO.</b>
<b>1.</b>	Descriptive analysis of age in the study population	<b>30</b>
<b>2.</b>	Distribution of study participants according to gender	<b>31</b>
<b>3.</b>	Distribution of study participants according to degree course	<b>32</b>
<b>4.</b>	Descriptive analysis of residence among the study population	<b>33</b>
<b>5.</b>	Descriptive analysis of income, Per Capita Income among the study population	<b>34</b>
<b>6.</b>	Descriptive analysis of total family members among the study population	<b>35</b>
<b>7.</b>	Descriptive analysis of SES among the study population	<b>36</b>
<b>8.</b>	Descriptive analysis of category among the study population	<b>37</b>
<b>9.</b>	Descriptive analysis of knowledge about climate change in the study population	<b>38</b>
<b>10.</b>	Comparison of Gender of study participants with baseline knowledge scores	<b>41</b>
<b>11.</b>	Comparison of Residence of study participants with baseline knowledge scores	<b>42</b>
<b>12.</b>	Comparison of Course of study participants with baseline knowledge scores	<b>43</b>
<b>13.</b>	Comparison of Socioeconomic Status of the study participants with baseline knowledge scores	<b>44</b>
<b>14.</b>	Descriptive analysis of knowledge score pre-test and post-test among study population	<b>45</b>
<b>15.</b>	Positive questions of Attitude Towards Climate Change in pre and post-test	<b>48</b>
<b>16.</b>	Negative questions of Attitude Towards Climate Change in pre and post-test	<b>50</b>
<b>17.</b>	Effect size of changes in positive attitudes towards climate change among participants	<b>52</b>

<b>18.</b>	Effect size of changes in negative attitudes towards climate change among participants	<b>54</b>
<b>19.</b>	Practices of study participants towards Climate Change	<b>55</b>
<b>20.</b>	Descriptive analysis of reasons for sustainable practices among the study population	<b>57</b>
<b>21.</b>	Effect size of changes in climate sensitive practices towards climate change	<b>58</b>
<b>22.</b>	Feedback on how effective the intervention was during post-test in the study population compared to pre-test	<b>61</b>

## LIST OF FIGURES

<b>S. NO.</b>	<b>FIGURES</b>	<b>PAGE NO.</b>
<b>1.</b>	Pie chart of age in the study population	<b>30</b>
<b>2.</b>	Distribution of study participants according to gender	<b>31</b>
<b>3.</b>	Distribution of study participants according to degree course	<b>32</b>
<b>4.</b>	Pie chart showing distribution residence among the study population	<b>33</b>
<b>5.</b>	Boxplot showing analysis of income and PCI of the study population	<b>34</b>
<b>6.</b>	Distribution of number of family members among the study participants	<b>35</b>
<b>7.</b>	Pie-chart of SES among the study population	<b>36</b>
<b>8.</b>	Bar chart showing distribution of categories in the study population	<b>37</b>
<b>9.</b>	Bar graph showing perceived effectiveness of overall interventional programme	<b>61</b>
<b>10.</b>	Word cloud of responses from exploratory analysis	<b>67</b>

## **INTRODUCTION**

The word “climate” has its roots in Greek, originally stemming from the word “klinein,” meaning to lean. “Climate” was used for over 100 years to refer to latitudinal zones before it started to be associated with weather conditions by 1600 CE.<sup>1</sup> Climate is the average weather conditions for a particular location over a long period of time, ranging from months to thousands or millions of years. The World Meteorological Organisation (WMO) uses a 30-year period to determine the average climate.<sup>2</sup>

Climate change refers to a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and an addition to natural climate variability observed over comparable time periods.<sup>3</sup> These changes are brought about by both natural phenomena and human activities. While the Earth's climate has undergone natural fluctuations throughout history, the current trends are different, due to their unprecedented rate and the overwhelming influence of human actions. The term “climate change” was first coined in a Science article (1975) by a scientist by the name of Wallace Broecker of Columbia University's Lamont-Doherty Geological Observatory.<sup>4</sup>

Historically, climate variations have been attributed to natural factors. Variations in the sun’s energy output, for example, can influence global temperatures over time.<sup>5</sup> Large volcanic eruptions release particles and gases, such as sulphur dioxide, into the atmosphere, temporarily cooling the planet by reflecting sunlight.<sup>6</sup> Additionally, the Earth’s orbit and axial tilt, known as Milankovitch cycles, cause gradual shifts in climate over tens of thousands of years.<sup>7</sup> These natural processes have led to cycles of ice ages and warmer interglacial periods, as evidenced by data from cores of icebergs and sedimentary layers.

From the time of the Industrial Revolution, human activities have become the dominant force driving climate change.<sup>8</sup> This period led to a drastic increase in emissions of greenhouse

gases. "Greenhouse gases" (GHG) means those gaseous components of the atmosphere, both man-made and natural, that take in and re-emit infrared radiation.<sup>9</sup> GHG act as a thermal blanket around the Earth, trapping heat that would otherwise escape into space. This heat trapping is called the "greenhouse effect".<sup>10</sup> This greenhouse effect is essential for maintaining a habitable climate. However, excessive GHG emissions have enhanced this effect, leading to global warming. Carbon dioxide, responsible for about 76% of global GHG emissions,<sup>11,12</sup> primarily stems from burning fossil fuels, which is a generic term for non-renewable energy sources such as coal, coal products, natural gas, derived gas, crude oil, petroleum products and non-renewable wastes.<sup>13</sup> Methane, approximately 25 times more effective than carbon dioxide (CO<sub>2</sub>) at trapping heat over a 100-year period, is largely emitted from agriculture and natural gas extraction. Nitrous oxide, with a warming potential about 300 times that of CO<sub>2</sub>, is released from fertilizers and industrial activities.<sup>14,15</sup> Together, these activities have disrupted the natural balance of the climate system on Earth.

Scientists have unequivocally linked recent climate change to human activities. The Earth's surface temperature since the late 1800s, has risen by roughly 1.2°C., with each of the last four decades being successively warmer than any preceding decade since 1850.<sup>12</sup> This warming is occurring roughly 10 times faster than natural post-ice-age warming, a fact confirmed by measurements from polar ice cores. These cores show a stark rise in CO<sub>2</sub> levels since the Industrial Revolution, far exceeding natural historical variations.<sup>16</sup>

The consequences of climate change extend across both ecosystems and human systems. Rising sea levels due to melting glaciers and polar ice caps threaten coastal communities, while the increased frequency and intensity of extreme weather events, such as hurricanes, floods and droughts, strain resources and infrastructure. Biodiversity is under threat as species struggle to adapt to changing habitats, and human health is at risk from heat stress, vector-borne diseases, and respiratory issues linked to air pollution. Food and water security are also jeopardized by disrupted agricultural systems and water scarcity, leading to economic challenges in vulnerable sectors like farming and coastal development.<sup>12</sup> It has been shown that by combining projections of climate models with temperature means and variability, rainfall patterns and extreme precipitation into economic damage, at 3 °C increase in the global average

temperature, losses for countries reach 10% of gross domestic product, with worst effects (up to 17%) in poorer, low-latitude countries.<sup>17</sup> Even management of allergic diseases is said to get complicated over the course of time.<sup>18</sup> In India, the situation is even more grim with production losses in rice, wheat, and maize alone estimated to go up-to USD 208 Bn and USD 366 Bn in 2050 and 2100 respectively.<sup>19</sup> If disease-related deaths are valued at lifetime earnings, the loss of economic output will be USD 2.5 Bn and USD 21 Bn in 2050 and 2100 respectively.<sup>19</sup> Additional power generation could require an incremental capital investment of USD 33 Bn and USD 123 Bn in 2050 and 2100 respectively to meet the higher cooling energy needs of India.<sup>19</sup>

Addressing climate change requires urgent action. The Intergovernmental Panel on Climate Change (IPCC) emphasizes the need to limit global warming to 1.5°C above pre-industrial levels to avoid catastrophic consequences.<sup>12</sup> Achieving this goal necessitates drastic reductions in GHG emissions, transitioning to renewable energy sources, reforestation efforts, and the adoption of sustainable practices across all sectors. Though climate change poses significant risks, it also presents opportunities for innovation, resilience, and collective action. Combating it demands an informed and cooperative effort by governments, businesses and individuals worldwide. The current Indian scenario is also under scrutiny by organisations and agencies worldwide. India, the third-largest emitter of GHGs,<sup>11,12</sup> faces unique challenges and opportunities: India is part of the five nations contributing to 62.7% of global GHG emissions,<sup>20</sup> but has pledged to achieve net-zero emissions by 2070.<sup>21</sup> A lot of emphasis has been put on national initiatives like "Lifestyle for Environment" emphasize sustainable living and climate education. Vulnerabilities specific to India include increased droughts, floods, and heatwaves, which significantly impact agriculture, health and livelihoods. Also, India is a hub for indigenous communities, which globally make up only 5 percent of the world's population. But they protect more than 20 percent of our planet's land and 80 percent of its biodiversity.<sup>22</sup> They also play a crucial role in preserving biodiversity and advocating for climate justice. However, as of September 2024, Climate Action Tracker rated India's efforts towards achieving these targets as "highly insufficient".<sup>23</sup>

Here is where we start to plan for the now and the future. And one of the ways to achieve this is through targeting the most impressionable members of society and the pioneers of tomorrow – the students. This study intends to bring about climate resilient behavioural

changes among the current generation such that the practices are carried forth and passed on to the next.

Climate change being something that we experience in all domains of life, should be explained beyond the textbooks through audiovisual aids to leave a lasting impact. Following the footsteps of some of the various global initiatives using video based education as a tool like the United Nations Educational, Scientific and Cultural Organization's (UNESCO) 'Climate Change Education for Sustainable Development' which integrates video to build "climate literacy" by visually demonstrating the real-world impact of global warming and solutions<sup>24</sup> or 'The Climate without Borders' network by the WMO<sup>25</sup> leverages weather presenters and videos to educate millions globally on climate change: in this study we aim to replicate the same amongst local undergraduate students.

The World Health Organization's (WHO) Health and Climate Change Survey report of 2021 says 46% of countries identified insufficient research and evidence as a barrier to implementation of national climate change strategies.<sup>26</sup> As with every policy that requires the cooperation of the people, educating and making people aware of the intended results brings about effective implementation of the policy. This study might help in bridging the barrier of understanding and cooperation of the young citizens.

**OBJECTIVE**

To assess effect of a video based educational intervention on the knowledge, attitude and practices of undergraduate college students towards climate change.

## **REVIEW OF LITERATURE**

A cross-sectional study was conducted in 2023 in Ghana among 500 undergraduate students from public universities. It aimed to assess awareness, attitudes, and knowledge about climate change. Results showed that 68% of students recognized climate change as a serious issue, but 42% exhibited significant knowledge gaps, and 36% held misconceptions regarding causes and solutions. Among those with knowledge gaps, females represented 56%, and first-year students were the most affected group. Additionally, only 22% of the participants could accurately identify human activities as a leading cause of climate change. The study also noted that students who attended extracurricular climate workshops had 1.5 times better awareness than those who did not ( $p < 0.05$ ). The researchers recommended incorporating tailored educational modules, interactive workshops and practical demonstrations to address these gaps and misconceptions.<sup>27</sup>

In "Beyond the Classroom: Influence of a Sustainability Intervention on University Students' Environmental Knowledge and Behaviours", study conducted in 2022 at a university campus in Canada, 200 students participated in a sustainability program involving workshops, peer discussions, and project-based activities. Post-intervention assessments revealed a 25% increase in knowledge scores ( $p < 0.01$ ), a 15% reduction in meat consumption ( $p = 0.03$ ) and 80% reported higher awareness of sustainable practices. The study found that 63% of students actively incorporated sustainable practices such as waste segregation and energy conservation post-intervention. Furthermore, students reported feeling more empowered, with 40% initiating sustainability discussions in their social circles. It emphasized the importance of informal, active and context-specific learning environments for fostering sustainable behaviour.<sup>28</sup>

A systematic review, "Worldwide Effects of Climate Change Education on the Cognitions, Attitudes and Behaviours of Schoolchildren and their Entourage" (2023), covered studies conducted between 2018 and 2022 across 15 countries, including the USA, India and Kenya. It examined 20 studies with over 10,000 participants aged 10-18 years. The review found a 30% improvement in knowledge scores (confidence interval [CI]: 28-32%) and a 20% increase in pro-environmental behaviours (CI: 18-22%) among students

---

and their families. The most notable changes were observed in regions where educational interventions included experiential learning, such as field trips and community engagement. The review also highlighted that gender differences were evident, with girls showing a 15% higher behavioural change rate compared to boys ( $p = 0.04$ ). The study highlighted interactive and localized educational materials as crucial in achieving positive outcomes in climate education.<sup>29</sup>

"Student Engagement and Environmental Awareness" (2022) was conducted in 2021 among 300 college students in the United States, focusing on the impact of student-directed eco-composition projects. Findings showed that 74% of participants improved critical thinking skills and reported deeper engagement with climate change topics ( $p < 0.05$ ). A further 58% noted an improvement in their ability to articulate climate-related arguments effectively. The study also observed that students who worked in groups demonstrated a 20% higher improvement in understanding complex issues compared to those who worked individually ( $p = 0.02$ ). The study concluded that creative, student-led projects significantly enhance environmental awareness and analytical abilities, with 82% of participants expressing willingness to advocate for climate policies.<sup>30</sup>

The article "Innovations in Undergraduate Teaching and Learning of Earth and Environmental Sciences" (2022) reviewed teaching methods among 1,000 students across 10 universities in Australia between 2019 and 2021. Using interactive tools such as augmented reality, simulation games and video-based lessons, the study observed a 40% improvement in students' understanding of environmental issues ( $p < 0.01$ ). Moreover, 45% of students reported feeling more confident in discussing climate topics post-intervention. The study also noted that students who interacted with simulation tools demonstrated a 30% higher retention of concepts compared to those relying on traditional lecture formats (CI: 25-35%). Researchers advocated for integrating technology-driven tools into the curriculum for better outcomes and enhanced student engagement.<sup>31</sup>

"Lens on Climate Change: Making Climate Meaningful through Student-Produced Videos" (2015) examined 120 high school students in Colorado, USA, during the 2014 academic year, engaged in creating short films on climate change topics. The study reported that 85% of students demonstrated improved understanding ( $p < 0.01$ ), and 65% felt more confident in communicating climate issues. Additionally, 72% expressed that the project encouraged them to research further about local climate challenges. Teachers observed that

the video project fostered collaboration skills, with 68% of students reporting better teamwork experiences. It highlighted the dual benefits of fostering knowledge and enhancing creative skills, recommending such projects as a key strategy for engaging students.<sup>32</sup>

A 2021 descriptive study conducted by UNICEF explored the participation of 1,348 teachers in Sweden in eco-actions and their perspectives on environmental education. The study revealed that only 11.1% of the teachers actively engaged in eco-actions, while 48% observed that students rarely took the initiative to participate in environmental activities on their own. This lack of proactive behaviour among students points to potential gaps in motivation, awareness, or the structure of environmental education. Furthermore, approximately 34% of teachers highlighted two significant barriers to teaching about climate change: insufficient training and the exclusion of climate change topics from the curriculum. This indicates systemic issues in preparing educators to effectively teach such critical content. Teachers expressed a strong demand for professional-led, interactive educational sessions that could equip them with the necessary skills, tools, and confidence to integrate environmental education into their teaching practices. The study underscores the importance of institutional support and targeted interventions to enhance teachers' and students' engagement with climate change education.<sup>33</sup>

In 2016, the UNDP conducted a descriptive study to evaluate the attitudes, knowledge and practices concerning climate change among 519 respondents in Grenada. The study revealed that 17.7% of participants considered climate change the most pressing issue they faced. This perception reflects the growing awareness of climate-related risks in the Caribbean, a region particularly vulnerable to hurricanes, sea-level rise and other climate-induced challenges. Notably, 69.8% of respondents strongly supported integrating climate change education into school curricula, recognizing the value of early intervention in fostering climate literacy. A deeper analysis showed that participants with higher levels of education, particularly those with tertiary qualifications, demonstrated significantly greater acknowledgement of climate change and expressed a strong desire to comprehend its impacts and solutions. These findings highlight the role of education as a critical determinant of climate awareness and advocacy. The study advocated for the inclusion of

climate change topics in formal education systems and public outreach programs to address knowledge gaps and promote community resilience.<sup>34</sup>

A cross-sectional study conducted in Kochi, Kerala, in 2018 assessed the attitudes, knowledge and practices of 176 high school students concerning global warming. The findings indicated that while students possessed a reasonable understanding of global warming, their individual practices to combat its effects were inadequate. For instance, few students reported participating in activities such as waste segregation, tree planting, or energy conservation. However, the study also revealed a promising attitude among the participants, with 85% agreeing that global warming could be mitigated through concerted and conscious efforts. This optimism points to the potential for behaviour change if students are provided with practical guidance and opportunities to translate their knowledge into action. The researchers recommended integrating hands-on environmental activities and community engagement projects into the school curriculum to encourage active participation in environmental conservation efforts.<sup>35</sup>

A 2021 cross-sectional study conducted among 903 medical students, including undergraduates and graduates in Karimnagar, Telangana, assessed their knowledge and practices related to climate change. The results revealed poor engagement in eco-friendly practices, with many participants failing to adopt behaviours such as reducing energy consumption, minimizing waste or supporting sustainable practices. However, a notable finding was the correlation between knowledge and behaviour: students who demonstrated a better understanding of climate change were more probable to engage in environmentally friendly actions. This highlights the critical part education plays in influencing behaviour. Medical students, as future healthcare professionals, are uniquely positioned to advocate for and implement strategies to address the health impacts of climate change. The study emphasized the need for targeted educational interventions, such as integrating climate change topics into medical curricula, to foster both awareness and actionable practices among medical students.<sup>36</sup>

In 2017, a cross-sectional study in Tehran, Iran, involving 108 lower secondary school teachers, evaluated their practices, attitudes and knowledge concerning climate change education. The findings revealed that while 75% of participants demonstrated moderate or increased awareness of climate change, their practical engagement was lacking, with only 52.8% reporting proactive behaviours such as incorporating environmental topics into their lessons or participating in eco-friendly initiatives. Alarming, 21.1% of teachers disagreed or strongly disagreed that human activities are a primary cause of climate change, reflecting the persistence of misconceptions among educators. These results highlight the urgent need for targeted teacher training programs to address knowledge gaps and misconceptions. The researchers emphasized the importance of embedding climate change education into teacher professional development programs to empower educators to deliver accurate and impactful environmental education to their students.<sup>37</sup>

A cross-sectional study titled “Perception, Attitudes and Practices regarding Climate Change among College Students in Coastal South India” was done in 2016 in Mangalore among 375 college students to assess the perception and attitude of students towards changing trends in climate and the measures practiced for mitigating the effects of climate change. The study revealed that the perception of climate change’s effects was mainly thought to be an increase in flooding ( $p=0.033$ ) with a rise in sickness and disease ( $p=0.031$ ). While all the students recognized climate change as a problem, they disagreed on its severity. The most common practices employed by the participants to mitigate climate change were saving of electricity and recycling practices. When comparing the practices among science students and non-science students, planting saplings and saving water were practiced more by the non-science students ( $p<0.05$ ). The study also highlighted the need for bringing about changes in the curricula of students.<sup>38</sup>

In 2023, a study done in Minnesota, USA evaluated the efficacy of a two-minute animated video designed to educate health professionals about the health risks of air pollution. The intervention involved 218 participants, including learners and clinicians from various health disciplines. Prior to the interventional video, 85.3% of respondents (186/218) said they had received "little" or "none at all" instruction or training regarding

the negative health effects of environmental variables including air pollution and climate change. Scores for seven of the twelve knowledge questions and the total composite score increased significantly from before to after the intervention (from 7.7 to 9.7,  $p < 0.001$ ). Findings of this study revealed significant improvements in participants' knowledge regarding the unfair effects of air pollution on health and increased ease in recognizing and counselling at-risk patients. Despite these gains, barriers such as duration of clinical consultations and insufficient training persisted. The study advocated for the integration of concise, animated educational tools in health professional training programs to address environmental health risks showing that this type of education can be extrapolated not just for undergraduates but to a professional setting as well.<sup>39</sup>

A 2024 study titled "Inquiring Sustainability through Dialogic Video Clubs in Upper Secondary Schools" analysed the capacity of 128 students to engage in dialogic sustainability inquiries within a video club setting. With the use of an interview guide, this approach facilitated in-depth discussions among students, enhancing their understanding and engagement with sustainability topics. The advantage highlighted in this method of involving students are that they can converse with other students regarding sustainability-related topics and therefore promotes deliberative accountability. There is no chance that the teacher will dominate or patronize the conversation because they are not there. The study underscored the effectiveness of dialogic methods in promoting critical thinking and active participation in environmental education.<sup>40</sup>

A 2020 study investigated the long-term effects of an intensive one-year university course on individual carbon emissions. They surveyed the participants for at least five years post-course, and the research found that the graduates reported making pro-environmental decisions, such as choices related to transportation and diet, which they attributed partly to their course experiences. The analysis estimated an average reduction of 2.86 tons of CO<sub>2</sub> per graduate per year. The course was designed in a way that community action projects and personal and career climate activities are used as tools for training the participants. This study highlighted the potential of comprehensive climate change education to fostering long lasting behavioural changes that contribute to carbon emission reductions.<sup>41</sup>

An article titled "Barriers to climate change and health research in India: a qualitative study" was conducted in Puducherry, India in 2023. The study involved 16 public health professionals, which included medical researchers and individuals engaged in environmental policies and planning within the region. With the use of key informant interviews, the researchers aimed to identify the perceived challenges which hinder environmental health research in Puducherry. Thematic analysis of the interviews revealed three primary barriers:

**Political and Institutional Barriers:** Participants highlighted a lack of political prioritization and support for climate change and health research. They noted weak interdepartmental coordination, which impede interdisciplinary research efforts.

**Education and Awareness Barriers:** There was a widespread agreement on the insufficient combining health and climate change topics in formal education curricula.

**Technical Research Barriers:** Limited technical expertise, inadequate research capacity, and difficulties in accessing health data were identified as significant obstacles for conducting comprehensive environmental health research.

This study highlighted the importance to enhance community and political awareness regarding the association between climate change and health. It advocated for strengthening technical research capabilities and improving health surveillance systems. Addressing these barriers is crucial for mitigating the impacts of climate change on health in India.<sup>42</sup>

An article titled "Health effects of climate change: an overview of systematic reviews" was conducted in Canada, including the University of Winnipeg, and Université Laval in 2019. This study aggregated and summarized findings from 94 systematic reviews associated with climate change impacts. These reviews encompassed diverse populations across different geographical regions.

The analysis revealed a growing research interest in the impacts of climate change on wellbeing in recent years. The reviews covered ten health outcome categories, with the three most common being infectious diseases, mortality, respiratory, cardiovascular or neurological outcomes. The majority of the systematic reviews were authored by

researchers connected to organizations in wealthy nations, highlighting a potential gap in research from low- and middle-income regions. But despite the extensive body of literature, many reviews were seen to have called for further research to better understand the complex relationships between climate change and health outcomes. This overview underscores the link between negative health effects and climate change, emphasizing the need for continued research, especially in underrepresented regions, to inform effective public health interventions and policy decisions.<sup>43</sup>

A mixed methods study done in 2024 titled " How climate change is shaping young people's health: a participatory, youth co-led study from Bangladesh, Guatemala and Nigeria " examined the multifaceted impacts of climate change on the health and well-being of adolescents and young people (AYP) across various regions. In Bangladesh and Guatemala, acute climate events such as flooding and cyclones have heightened the perceived risk of early marriage and gender-based violence among AYP. The research also highlighted the adaptive strategies employed by young people and their communities, such as migration, changes in livelihood practices, and community-based disaster preparedness initiatives. The authors advocated for targeted policies that address the unique vulnerabilities of AYP in the context of climate change, emphasizing the need for youth-centred investment in education to enhance resilience. The study in conclusion proposed collaborative efforts among policymakers, healthcare providers and communities to develop and implement interventions that safeguard the health and future of adolescents and young people in a changing climate.<sup>44</sup>

A study done in Connecticut, USA, in 2018 was done among 1,011 health professional students, including those seeking degrees in physician assistant, nursing, and medicine schools. 337 of the 1,011 students who were invited answered, yielding a 33.3% response rate. According to the poll, 96.1% (324 respondents) of respondents believed that human activity was the primary cause of climate change, while 98.2% (331 respondents) accepted its presence. 32.9% (111 respondents) were confused about the health care sector's contribution to pollution, but 57.3% (193 respondents) acknowledged the sector's role. Out of 325 respondents, 96.4% agreed that health professionals have a duty to reduce waste and save resources in clinical settings when questioned about their role in supporting

sustainable practices. Only 51 respondents, or 15.1%, said they were aware with the idea of environmental stewardship in the medical field. The respondents' interest in learning more about these subjects was also evaluated by the survey. Of the 271 respondents, a significant 80.4% conveyed the need to find out more about sustainable practices and the effects of health care on the environment. When it came to addressing pollution, climate change and resource conservation in patient care and professional practice, female and physician assistant students demonstrated a stronger dedication than male and medical students, respectively.<sup>45</sup>

## **MATERIALS AND METHODS**

### **Source of Data**

The study population comprised undergraduate college students from Belagavi city in Karnataka, India. These students were considered as they represent a demographic that is likely to be receptive to educational interventions on climate change and for inculcating resilient practices.

### **Study Design**

This study followed a facility-based interventional design, utilizing a Before-After (pre-post) methodology. The choice of this design was based on the need to evaluate changes in knowledge, attitudes and practices related to climate change after a structured educational intervention. The pre-post design allows for the direct comparison of outcomes within the same participants, minimizing variability and ensuring that changes can be attributed to the intervention.

### **Study Period**

The study was conducted over a period of 12 months, from 1<sup>st</sup> April 2023 to 31<sup>st</sup> March 2024. This timeline included phases of planning, pilot testing, data collection, intervention implementation and post-intervention evaluation. The extended duration was kept in place so as to allow sufficient time to observe the practical application of knowledge gained by the participants with regards to climate resilient behaviour.

### **Sample Size Estimation**

To ensure the validity and reliability of the research findings, the sample size was calculated using the G\*Power software, a well-recognized tool for statistical power analysis. The calculation was performed for a t-test assessing the difference between two dependent means, which is considered appropriate for studies involving paired data, such as pre- and post-intervention measurements.

### **Parameters for the Calculation:**

The following parameters were input into the G\*Power software:

1. Effect Size (d): 0.25

- The effect size represents the magnitude of the expected difference between the two dependent means, standardized by the variability of the outcome. For this study, an effect size of 0.25 was chosen, corresponding to a small-to-moderate effect as per Cohen's guidelines (small = 0.2, medium = 0.5, large = 0.8).
- This value was selected based on the findings of a meta-analysis conducted by Nisa et al.<sup>46</sup>, which reviewed randomized controlled trials testing behavioural interventions. The meta-analysis reported effect sizes in a similar range for interventions aimed at modifying behaviour. While the specific context of the meta-analysis chosen as reference was related to household actions on climate change, the intervention effects observed in the study provide a reasonable basis for estimating the expected effect size in this study's population.

2. Alpha Error (Type I Error): 0.01

- The alpha error was set at 0.01, indicating a 1% probability of rejecting the null hypothesis when it is true. This strict threshold of significance minimizes the risk of false positives, ensuring sound conclusions.

3. Beta Error (Type II Error): 0.05

- The beta error was set at 0.05, corresponding to a study power of 95% (1 - beta). This high power ensures a 95% likelihood of finding a real difference, if one exists, reducing the likelihood of false negatives.

4. Study Design:

- The test was specified as a two-tailed t-test, accounting for the possibility of differences in either direction between the dependent means.

### Calculation Results

Based on the parameters described above, the initial estimated sample size required to achieve the desired power was 289 participants. This number ensures that the study has sufficient

statistical power to detect a meaningful difference between the pre- and post-intervention measures.

#### Adjustment for Attrition

To account for potential dropouts or non-compliance among participants, a 10% attrition rate was incorporated into the calculation. This adjustment was applied by multiplying the initial sample size by a factor of 1.1

$$n_{adjusted} = n \times (1 + r) = 289 \times 1.1 = 317.9$$

To simplify the recruitment process and ensure clarity, the adjusted sample size was rounded up to 320 participants.

#### Rationale and Significance

The chosen parameters, particularly the effect size, were informed by established literature to ensure that the calculation reflects realistic expectations for the intervention's impact. The effect size of 0.25 reflects a conservative estimate, considering the intervention's likely small-to-moderate effects. The use of a high power (95%) and a stringent alpha level (0.01) ensures the study's findings are both statistically and realistically significant.

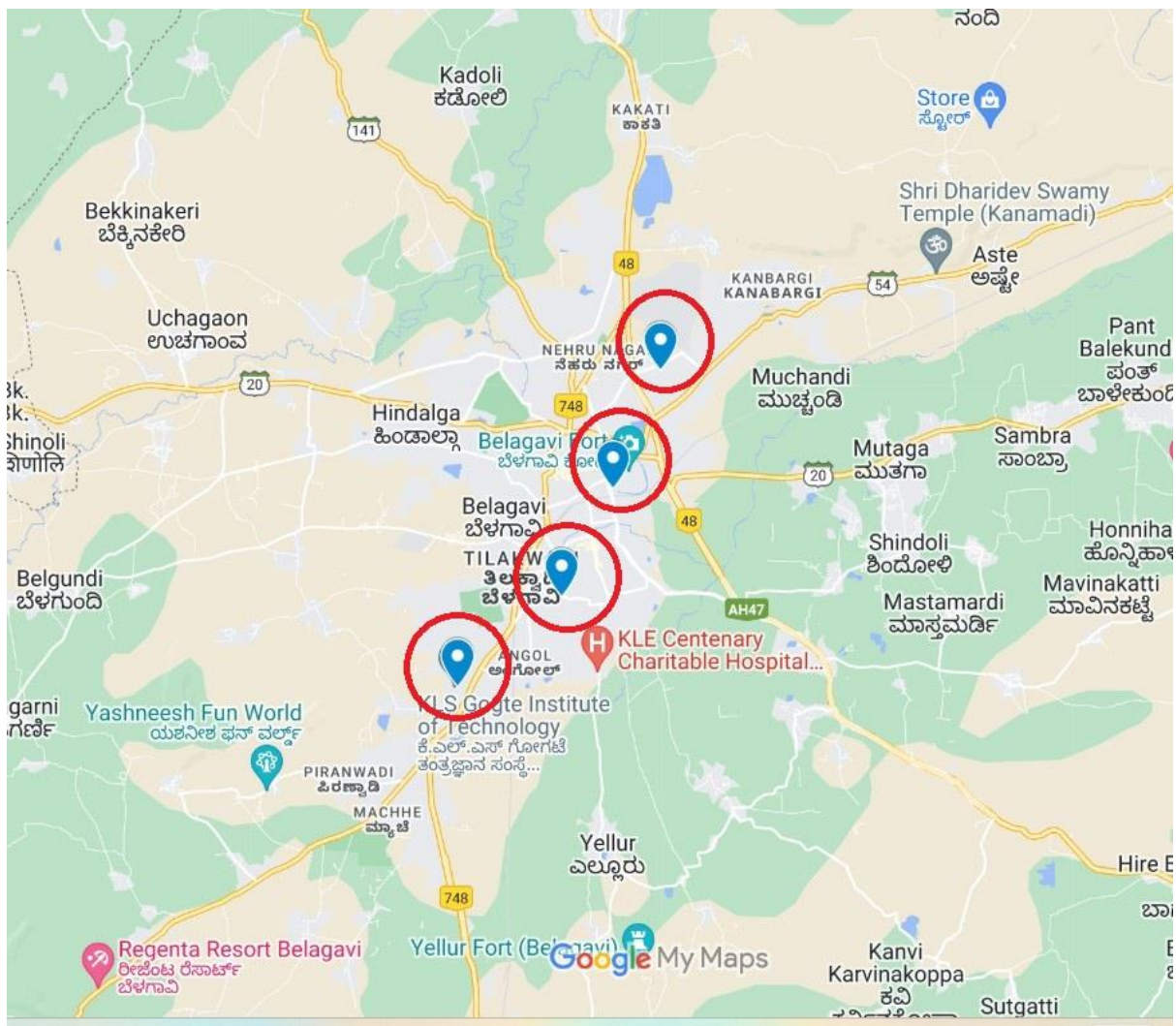
By incorporating an adjustment for attrition and rounding up the final sample size, the study design anticipated and addressed potential challenges in participant retention, further reinforcing the dependability of the findings.

This comprehensive approach to sample size calculation ensured that the study is adequately equipped to detect meaningful effects and contribute valuable insights to the field being researched.

## Sampling Frame

Belagavi city in the state of Karnataka, India, is administratively divided into two constituents—North and South. For logistical feasibility and to ensure geographical representation, two colleges from each zone were selected randomly. The Deputy Director for Degree Colleges in Belagavi city provided the full list of colleges, ensuring inclusivity and diversity in the sample selection. Random selection of colleges was done and this minimized selection bias and ensured fair representation of students from different educational backgrounds. Permission was obtained from the concerned principals of the selected colleges to conduct the research study in their premises. The questionnaires for the pre-test, the structured educational intervention and the post-test were administered in the classrooms after securing prior permission for each.

**Map 1. Map showing location of colleges selected for data collection.**



### Sampling Technique

After selecting the colleges, proportionate sampling was employed to ensure that the sample size from each college reflected the number of new undergraduate admissions in the academic year 2023-24. Proportionate sampling ensures that larger colleges contribute a higher number of participants while maintaining the overall representativeness of the sample. The detailed breakdown of the sample is as follows:

<b>Name of the College</b>	<b>Total Strength of New UG Admissions</b>	<b>Population Proportionate Sample</b>
KLE Society's RL Law College, Belagavi	120	39
KLS Gogte Institute of Technology, Belagavi	340	110
Bharatesh Education Society's College of Computer Applications, Belagavi	280	90
Sangolli Rayanna Government First Grade Constituent College, Belagavi	250	81
<b>Total</b>	<b>990</b>	<b>320</b>

**Inclusion Criteria:**

The study included:

1. First-year undergraduate students from the selected four degree colleges.
2. Students willing to provide written informed consent for participation in the study.

**Exclusion Criteria:**

The study excluded:

1. Students who were absent during the pre-test assessment.
2. Students who declined to provide written informed consent.

**Ethical Clearance:**

Ethical clearance was obtained from the Institutional Ethical Committee for Human Subjects' Research of the medical college, for research vide reference number MDC/JNMCIEC/43 dated 31/03/2023.

Informed consent in writing was acquired from all the study participants before the data collection. They were informed in detail about the study's objective and their rights, possible benefits and risks involved. Privacy and confidentiality among the individuals involved were maintained throughout the conduction of the study.

**Questionnaire Validation:**

For the overall reliability, the pre-test questionnaire was internally validated using Cronbach's alpha. And the cumulative value obtained was 0.919, while 0.86 and 0.978 were the alpha values for the knowledge and attitude respectively. Thus, the questionnaire was feasible to conduct the study among the target population.

## **Data Collection Procedure:**

### Pilot Study

Before the main study, A pilot study was carried out between 10 undergraduate students to test the feasibility of the research design and the validity of the questionnaire. Feedback from this pilot study was used to refine the questionnaire, ensuring clarity, relevance and reliability.

### Questionnaire Design

The research questionnaire was made up into four distinct sections:

The research titled “**Assessment of Video-Based Educational Program on Knowledge, Attitudes and Practices towards Climate Change among Undergraduate College Students of Belagavi**” employed a structured and pre-designed questionnaire for data collection. This document provides a detailed breakdown of the components of the predesigned and structured questionnaire used in the study.

## **1. Socio-demographic details of the study participants**

This section captures essential background information of the participants, including:

- **Name, Age and Sex:** Basic identification details to contextualize participant responses.
- **Area of Residence:** Categorized as urban or rural to understand the influence of geography on climate change perceptions.
- **Degree/Course:** Educational background to analyse knowledge levels.
- **Family Income and Composition:** Economic and social contexts that may affect attitudes and practices.

**Socio-Economic Status:**

Information regarding per capita income (INR/month) was collected and the SES was classified using Modified B.G. Prasad's classification for the year 2024.<sup>47</sup> The B.G. Prasad's scale was first introduced in the year 1961. It was calculated by considering the base Consumer Price Index (CPI) as 100 for the year 1960. It was later modified by introducing the Linking Factors 4.63, 4.93, 2.88 for the year 1982, 2001 and 2016 respectively as provided by the Labor Bureau, Govt of India

Consumer Price Index (IW) for November 2024 was 144.5<sup>48</sup>

Multiplication factor = Current CPI (144.5)/Base index value in 2016 (100) = 1.445

The following formula is used to get the new income value:

New income value = Multiplication factor (MF) × Old income value × 4.63 × 4.93 × 2.88.

Upon substituting the values in the equation, the updated ranges for November 2024 were calculated as shown below.

Revised BG Prasad's Socio-economic Status Classification, November 2024

SES Class	Old income value	New Income Value
Class I	100₹ and above	> 9405₹
Class II	50-99₹	4655-9405₹
Class III	30-49₹	2756-4655₹
Class IV	15-29₹	1425-2755₹
Class V	<15₹	< 1425₹

- **Caste/Category:** Included for equitable representation and subgroup analysis.
- **Per Capita Income:** It is the average income earned per person in a given family.

## **2. Knowledge with regards to Climate Change**

This section measures participants' awareness and comprehension of climate change through a series of questions, such as:

- Awareness of terms like “climate change” and “greenhouse gases.”
- Knowledge of key contributors to climate change, including deforestation, carbon emissions, and industrial activities.
- Understanding of specific phenomena, such as the greenhouse effect and carbon emissions.
- Information sources about climate change (e.g., family, social media, newspapers).

## **3. Attitude towards Climate Change**

The attitude section employs a five-point Likert scale to gauge participants' beliefs and opinions. Statements range from ‘strongly agree’ to ‘strongly disagree’ and addresses:

- Responsibility for climate change (e.g., human actions, government involvement).
- Perceptions of the severity and impact of climate change, not just globally but locally also.
- Support for solutions, including renewable energy, carbon taxes, and waste recycling.
- Willingness to adopt sustainable practices and prioritize environmental protection over expenditure and general economic growth.

## **4. Practices related to Climate Change**

Participants' behavioural responses to climate change are assessed through ‘yes/no’ questions about:

- Eco-friendly consumption (e.g., using recyclable bags, energy-saving appliances).
- Actions to reduce carbon footprints (e.g., using public transportation, carpooling, reducing plastic use).
- Community involvement, such as tree planting and waste segregation.

- Adoption of renewable energy technologies like solar heaters.
- Influences on practices, such as convenience, cost-saving, or moral obligation.

### **5. Open-Ended Questions**

This study employed a qualitative research approach to explore undergraduate students' perceptions and proposed solutions regarding climate change. Data was collected using an open-ended survey question, which asked participants: *“Can you think of any other eco-friendly activities you have engaged yourself with in the past year?”* and *“Do you have any suggestions on any innovative practices or attitudes that can be adopted for the betterment of the environment?”*

Responses were collected in written format, ensuring a diverse range of opinions from students across different disciplines. Participants were encouraged to provide detailed answers based on their personal beliefs, observations, and experiences.

### **6. Effectiveness of the Educational Video**

Participants from each college completed the pre-test on a designated single day to minimize knowledge contamination. This ensured that students could not share questionnaire details before completing the test. Written informed consent was acquired from all participants before data collection. The pre-test aimed to assess baseline knowledge, attitudes and practices related to climate change.

#### Intervention

The intervention consisted of:

1. Introduction: A 15-minute PowerPoint presentation was prepared and delivered by the investigator to groups of students (maximum 40 per group) to explain the intent of the study and provide a brief overview of climate change.
2. Educational Video: A 16-minute free-to-use video obtained from the organization GoClimate<sup>49</sup> was shown to the participants. This video provided detailed insights into climate change and its impacts. An LCD projector connected to a computer was used to display the video to each group. The video had subtitles/captions in English such that there would be a less chance of not comprehending the video content.

3. Interactive Session: After the video was shown, an interactive discussion session was conducted in the same session to address participants' questions and clarify their doubts about climate change, the content of the video, the contents of the presentation and the purpose of the study.
4. Handouts: At the end of the session, informational handouts (annexure 1) were distributed to reinforce learning.

### Post-intervention

After a minimum gap of one month after the intervention, the same research questionnaire was administered to the same participants in the classroom. This time gap allowed participants to internalize and apply their newly acquired knowledge while reducing recall bias. Data from the post-test were used to evaluate changes in knowledge, attitudes and practices. There were no dropouts or exclusions during the course of this study. To ensure the students who were absent on the second session were included, the post-test was administered for them on the next day they attended regular college sessions with the help of the concerned school authorities.

Also, along with the post-test, participants were asked to rate the video's effectiveness on a scale ranging from "Not Effective" to "Very Effective." This helped evaluate the impact of the educational material.

### **Data Processing and Statistical Analysis**

#### 1. Data Entry and Coding:

- Collected data were coded and typed into Microsoft Excel. Data cleaning was performed to ensure accuracy and completeness. A master chart was prepared for understanding the coding and for guiding the analysis.
- For the qualitative part, once the responses were collected, they were transcribed into MS Word using the Google speech to text application and input into NVivo 13/R1, 2020 edition,<sup>50</sup> which is a qualitative data analysis software for systematic coding and categorization. Each response was carefully examined to identify key phrases, recurring concepts and distinctive viewpoints. A thematic analysis approach was adopted to identify patterns and categorize the responses into broader themes. Initially, an

inductive coding method was applied, wherein responses were read multiple times to allow themes to emerge organically. After an initial set of themes was developed, a deductive approach was employed to refine and consolidate overlapping themes, ensuring clarity and coherence.

- The second part of qualitative analysis was done employing the formation of a '**word cloud**'. This is a type of novel '**exploratory qualitative analysis**' and reader-friendly approach for presentation of qualitative data.<sup>51</sup>
- The CASP checklist for qualitative research was employed to ensure adherence to appropriate methodology, analysis and presentation of results.<sup>52</sup>

## 2. Descriptive Statistics:

- Categorical data were analysed by calculating percentages and proportions.
- Visual representations such as graphs and charts were prepared to illustrate key findings.

## 3. Inferential Statistics:

- Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Non normally distributed quantitative variables were summarized by medians. Data was also represented using appropriate diagrams like bar diagram, pie diagram.
- Using visual examination of histograms and normality Q-Q plots, all quantitative variables were examined for a normal distribution within each category of explanatory variables. Additionally, the Shapiro-Wilk test was used to evaluate the normal distribution. Shapiro wilk test with p value of  $>0.05$  was considered as normal distribution.
- For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups). For non-normally distributed Quantitative parameters, Medians and Interquartile range (IQR) were compared between study groups using Mann Whitney U test (2 groups) / Kruskal Wallis test ( $> 2$  groups). The change in the quantitative parameters, before and after the

intervention was assessed by paired t-test (In case of two time periods) or one-way repeated measures ANOVA (In case of comparison across more than 2 time periods).

- Categorical outcomes were compared between study groups using Chi square test / Fisher's Exact test (If the overall sample size was  $< 20$  or if the expected number in any one of the cells was  $< 5$ , Fisher's exact test was used.).
- For t-tests, Cohen's  $d$  was calculated to measure the effect size of the mean difference between groups. Cohen's  $d$  is computed as the difference between two means divided by the pooled standard deviation. It provides an indication of the standardized difference, with commonly interpreted benchmarks suggesting that  $d = 0.2$  represents a small effect,  $d = 0.5$  a medium effect, and  $d = 0.8$  a large effect.
- Cohen's  $w$  (Chi-square Effect Size) was calculated for categorical data comparisons between pre-test and post-test proportions. Interpretation (Cohen, 1988 Guidelines):  
**Small effect:**  $w=0.10$  (Weak association)  
**Medium effect:**  $w=0.30$  (Moderate association)  
**Large effect:**  $w=0.50$  (Strong association)
- For chi-square tests, Cramér's  $V$  was used to assess the strength of association between categorical variables. Cramér's  $V$  is derived from the chi-square statistic and is scaled between 0 and 1, where **0** indicates no association and **1** indicates a perfect association. The magnitude of the effect is interpreted based on the degrees of freedom, with thresholds of **0.1** indicating a small effect, **0.3** a medium effect, and **0.5** a large effect.
- P value  $< 0.05$  was considered statistically significant.
- Data was analysed by using SPSS software, version 22.<sup>53</sup>
- Software:
  - Statistical analysis was conducted using IBM SPSS South Asia Limited software version 22, for advanced data analysis.<sup>53</sup>
  - Qualitative analysis performed by the NVivo 13/R1, 202 Edition software.<sup>50</sup>

## **Thematic Analysis and Categorization**

Key themes identified included:

1. **Sustainability and Environmental Conservation**
2. **Policy Action and Government Responsibility**
3. **Waste Management and Recycling**
4. **Education and Awareness**
5. **Personal Responsibility and Community Efforts**

Based on the statement's main topic, each response was assigned to one or more themes. This preserved the variety and depth of student viewpoints while enabling an organized presentation of the results.

## **Ensuring Data Saturation**

Data saturation was achieved by continuously going through all the responses until no new themes emerged. Redundant and similar responses were categorized under existing themes, ensuring the dataset is complete.

## **Exploratory Analysis using word cloud -**

A **word cloud** is a visual representation of text data where the size of each word corresponds to its frequency or importance in a given dataset. It helps to quickly identify key themes, trends, and commonly mentioned topics. In this case, the word cloud reflects the responses to two questions:

1. "Can you think of any other eco-friendly activities you have engaged yourself with in the preceding year?"
2. "Do you have any suggestions on any innovative practices or attitudes that can be adopted for the betterment of the environment?"

### **Participant Coding System**

To ensure anonymity while maintaining the ability to track individual responses across different time points, a timepoint-based coding system was used. Each participant was assigned a unique identifier (e.g., P12 for Participant 12), followed by a suffix indicating the stage of data collection.

- T1 (Time 1) refers to responses collected during the pre-test phase.
- T2 (Time 2) refers to responses collected during the post-test phase.

Throughout the qualitative study, this coding scheme was used consistently, especially when direct quotes were being presented. By following these guidelines, the study maintains participant confidentiality while guaranteeing reporting transparency.

## RESULTS:

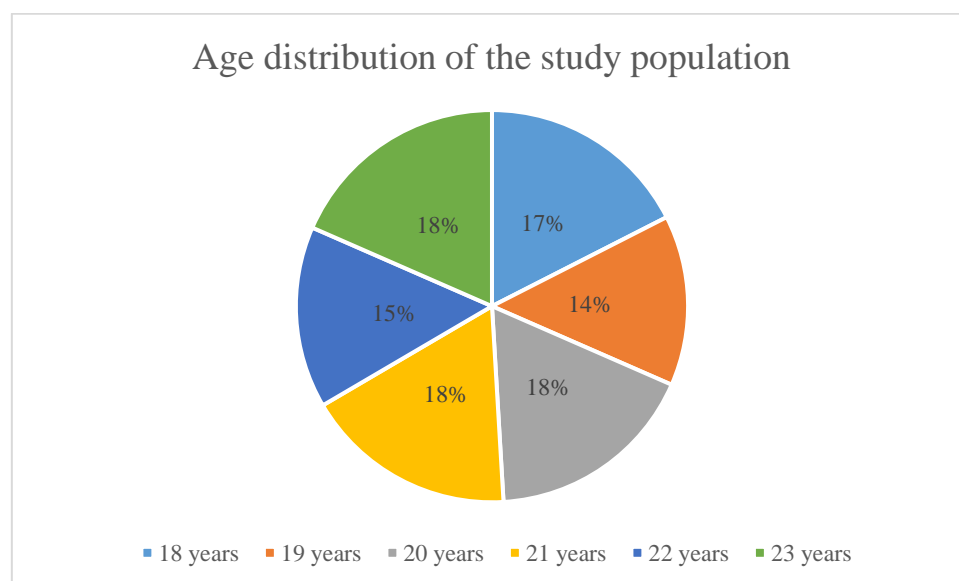
A total 320 subjects were included in the final analysis.

**Table 1: Descriptive analysis of age in the study population (N=320)**

Age (in years)	Frequency	Percentages
18	56	17.50%
19	45	14.06%
20	56	17.50%
21	56	17.50%
22	48	15.00%
23	59	18.44%

Among total 320 study participants, it was found to be a fairly uniform distribution of participants with respect to their age. The study participants of the ages 18,20 and 21 years comprised 17.50% each, while 14.06% participants fell into the age group 19. There were 48 participants aged 22 which was 15% of the total. The age group of 23 had the largest proportion of participants with 18.44%. The mean age of the study population was  $20.54 \pm 1.75$  years.

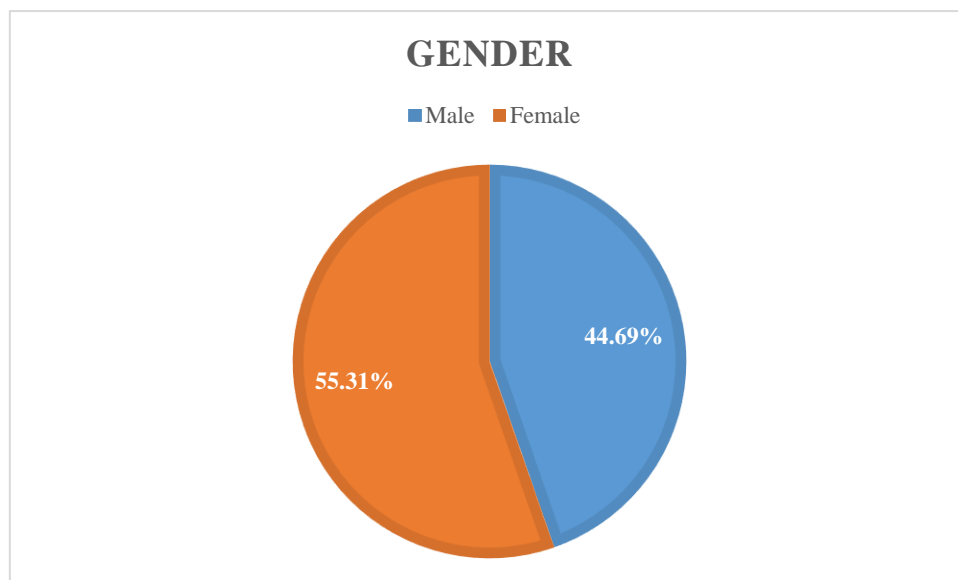
**Figure 1: Pie chart of age in the study population (N=320)**



**Table 2. Distribution of study participants according to gender (N=320)**

<b>Gender</b>	<b>Frequency</b>	<b>Percentages</b>
Male	143	44.69%
Female	177	55.31%

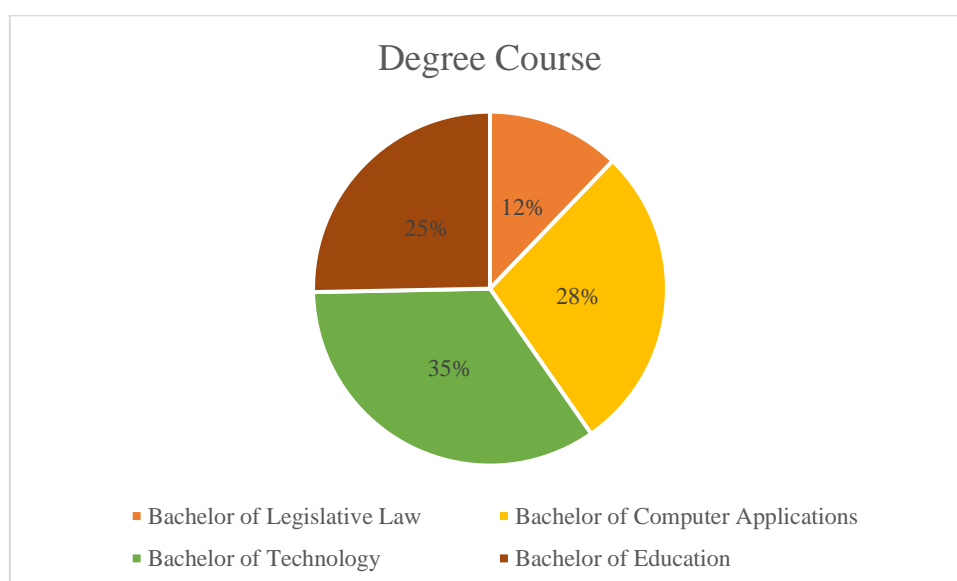
Among the 320 individuals that participated in the study, the majority were females, accounting for 55.31% (177 participants), while 44.69% (143 participants) were males.

**Figure 2. Distribution of study participants according to gender (N=320)**

**Table 3. Distribution of study participants according to degree course (n=320)**

<b>Degree Course</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Bachelor of Legislative Law</b>	39	12.2
<b>Bachelor of Computer Applications</b>	90	28.1
<b>Bachelor of Technology</b>	110	34.3
<b>Bachelor of Education</b>	81	25.4

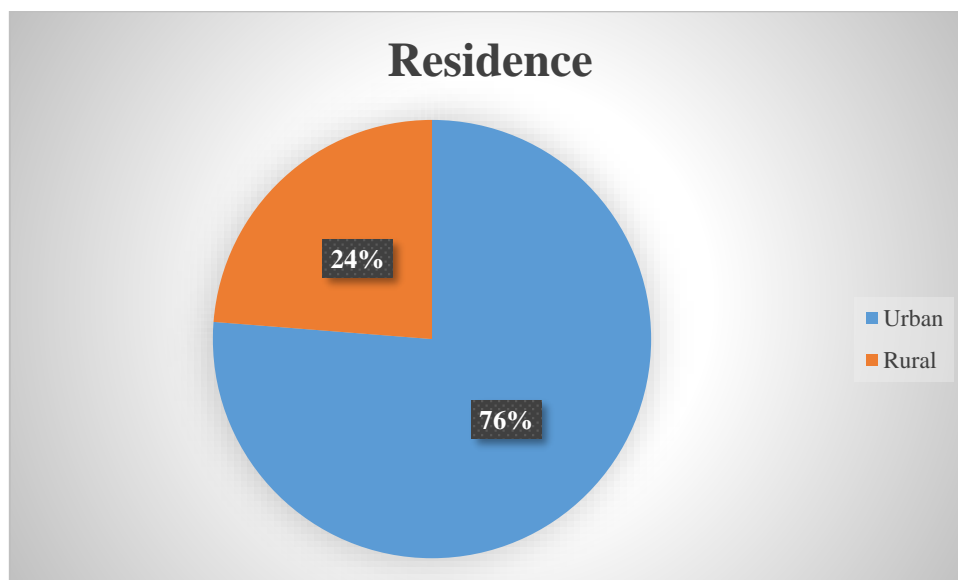
Out of the total 320 participants, 34.3% (110 individuals) were pursuing a degree in Bachelor of Technology, making it the largest group. Following that, 28.1% (90 individuals) were undergoing their Bachelor's in Computer Applications, 25.4% (81 individuals) were pursuing a Bachelor's degree in Commerce and lastly, 12.2% (39 individuals) were enrolled in a degree in Bachelor of Legislative Law.

**Figure 3. Distribution of study participants according to degree course (n=320)**

**Table 4. Descriptive analysis of residence among the study population (N=320)**

Residence	Frequency	Percentages
Urban	244	76.25%
Rural	76	23.75%

The majority of study participants, 76.25% (244 individuals), resided in urban areas, while the remaining 23.75% (76 individuals) were from rural areas. This indicates that the study sample was predominantly urban.

**Figure 4: Pie chart of residence among the study population (N=320)**

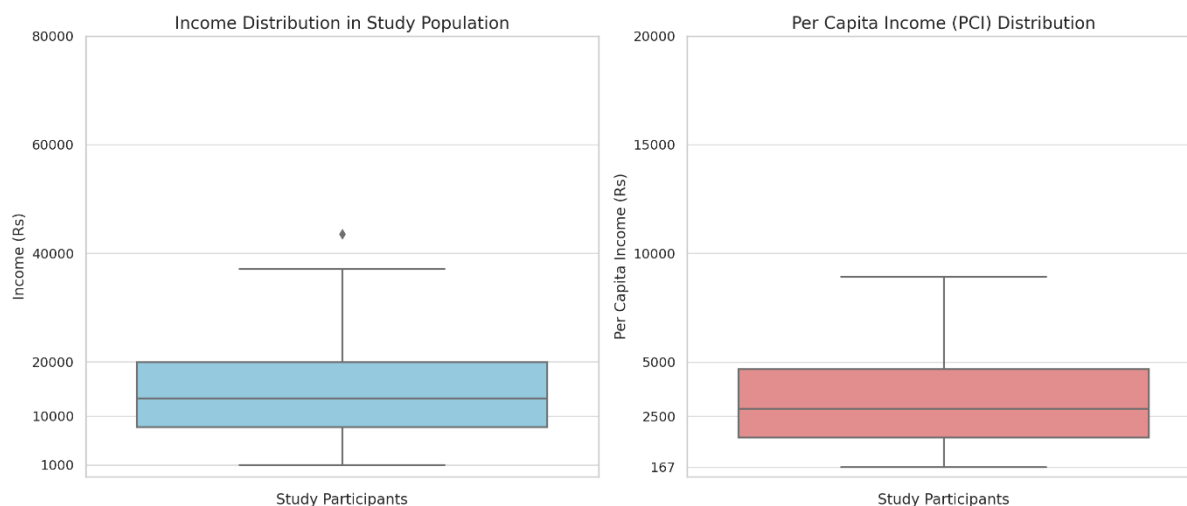
**Table 5: Descriptive analysis of income, Per Capita Income among the study population (N=320)**

Parameter	Mean $\pm$ SD	Median	Minimum	Maximum
Income in Rs./month	13,678.13 $\pm$ 9146.98	10,000.00	1,000.00	80,000.00
Per Capita Income in Rs./month	2,860.89 $\pm$ 2248.7	2,500.00	167.00	2,0000.00

- **Income:** The mean monthly income of study participants was Rs. 13,678.13 ( $\pm$  9,146.98), with a median of Rs. 10,000. The income range varied widely, from a minimum of Rs. 1,000 to a maximum of Rs. 80,000.
- **Per Capita Income (PCI):** The mean per capita income was Rs. 2,860.89 ( $\pm$  2,248.7), with a median of Rs. 2,500. The lowest PCI reported was Rs. 167, while the highest was Rs. 20,000.

Both monthly income and Per Capita Income showed substantial variation among the study participants, with larger standard deviations indicating considerable difference in financial status.

**Fig 5: Boxplot showing analysis of income and PCI of the study population**

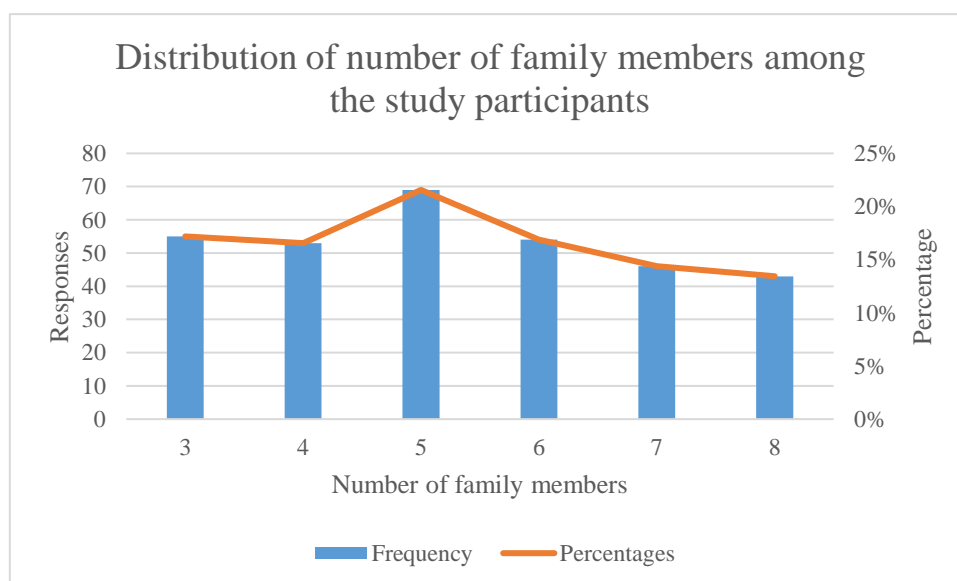


**Table 6: Descriptive analysis of total family members among the study population (N=320)**

Total Family Members	Frequency	Percentages
3	55	17.19%
4	53	16.56%
5	69	21.56%
6	54	16.88%
7	46	14.38%
≥8	43	13.44%

The most common family size among participants was **5 members** (21.56%), followed by **3 members** (17.19%) and **6 members** (16.88%). Households with **4 members** made up 16.56% of the sample, while larger families with **7 members** (14.38%) and **8 members** (13.44%) were less common.

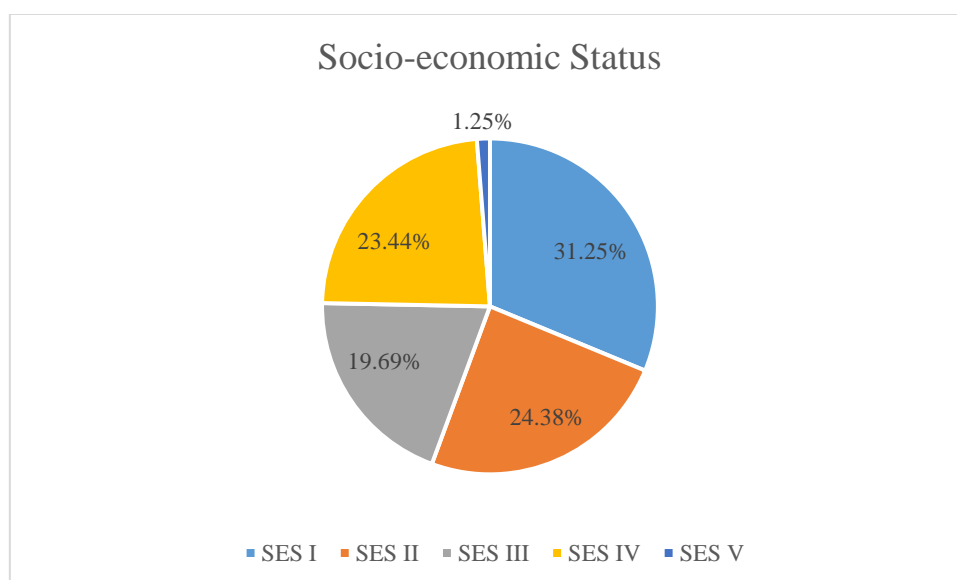
**Fig 6: Distribution of number of family members among the study participants**



**Table 7: Descriptive analysis of SES among the study population (N=320)**

SES (as per modified BG Prasad's classification)	Frequency	Percentages
Class I	100	31.25%
Class II	78	24.38%
Class III	63	19.69%
Class IV	75	23.44%
Class V	4	1.25%

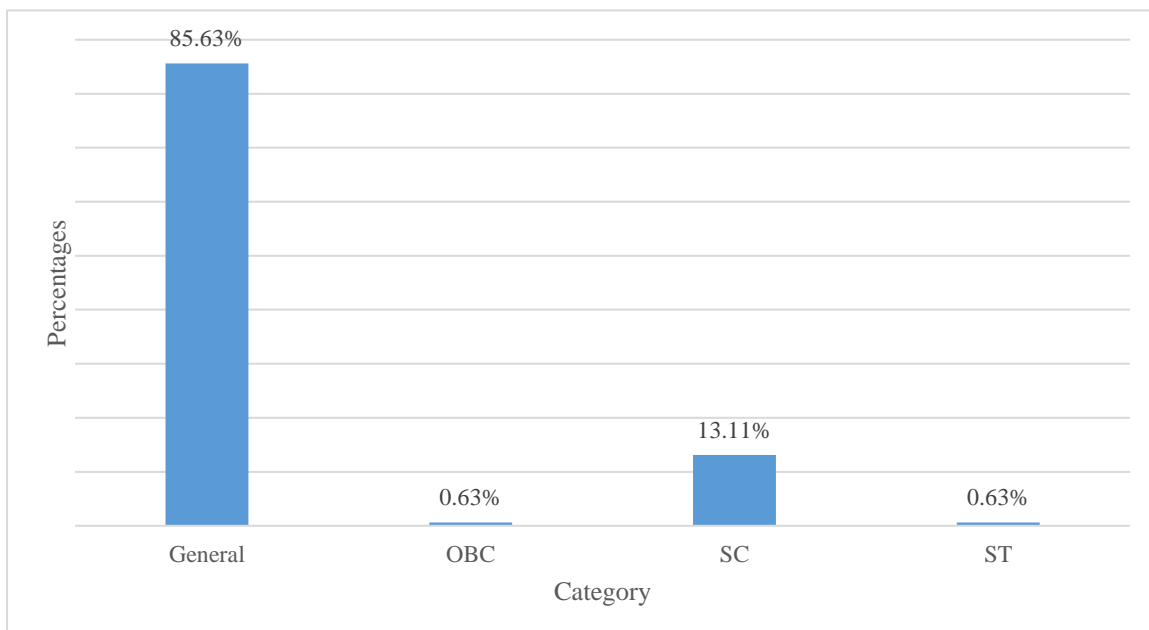
Socioeconomic classification was divided into five levels according to modified BG Prasad's classification, with the highest proportion of study participants (31.25%) belonging to **SES I**. This was followed by **SES II (24.38%)**, **SES IV (23.44%)**, and **SES III (19.69%)**. The lowest SES category (**SES V**) had only **1.25%** of participants, showing that most individuals that participated in this study belonged to middle or higher socioeconomic strata.

**Figure 7: Pie-chart of SES among the study population (N=320)**

**Table 8: Descriptive analysis of category among the study population (N=320)**

Category	Frequency	Percentages
General	274	85.63%
OBC	2	0.63%
SC	42	13.11%
ST	2	0.63%

A substantial majority of the study participants belonged to the **General category (85.63%)**, while **SC/ST participants constituted 13.75%**. The **OBC category** was the smallest group, with only **0.63%** of participants.

**Figure 8: Bar chart showing distribution of categories in the study population (N=320)**

**Table 9: Descriptive analysis of knowledge about climate change in the study population (N=320)**

'Knowledge about climate change'	Options	Pre-test Response		Post-test Response	
		n	%	N	%
2.1 Have you heard about 'climate change'?	Yes	291	90.94%	316	98.75%
	No	29	9.06%	4	1.25%
2.2 Do you think 'climate' and 'weather' are the same?	Yes	291	90.94%	58	18.13%
	No	29	9.06%	262	81.88%
2.3 Do you think 'climate change' is a global emergency?	Yes	260	81.25%	269	84.06%
	No	60	18.75%	51	15.94%
	Don't know/Not Sure	0	0%	0	0%
2.4 What do you think 'climate change' is?	Increase or decrease in temperature	78	24.38%	235	73.44%
	Change in rainfall patterns	29	9.06%	75	23.44%
	Increase in the frequency of floods/ cyclones or natural disasters	28	8.75%	88	27.50%
	I don't know / I am not sure	79	24.69%	28	8.75%
2.5 What do you think is the cause/reason for 'climate change'?	1,2,4*	78	24.38%	-	-
	1,2,5*	87	27.19%	-	-
	1,3,4*	76	23.75%	-	-
	1,3,5*	79	24.69%	-	-
2.6 Do you understand the term "greenhouse gases"?	Yes	294	91.88%	320	100%
	No	26	8.13%	0	0%

2.7 What are “greenhouse gases”?	CO <sub>2</sub>	70	21.88%	235	73.44%
	CH <sub>4</sub>	68	21.25%	78	24.38%
	N <sub>2</sub> O	54	16.88%	7	2.18%
	H <sub>2</sub> O	66	20.63%	0	0%
	All of the above	62	19.38%	0	0%
2.8 Burning of fossil fuels results in	Increased oxygen level	140	43.75%	0	0%
	Increased ethane level	96	30.00%	158	49.38%
	Increased greenhouse gases	64	20.00%	162	50.63%
	Decreased greenhouse gases	20	6.25%	0	0%
2.9 Which of the following do you agree about the ‘greenhouse effect’?	1.Life on earth is possible due to greenhouse effect	0	0%	0	0%
	2.Greenhouse effect maintains the earth’s natural temperature	67	20.94%	0	0%
	3.More greenhouse gases results in more temperature	81	25.31%	60	18.75%
	4.Increased emission of greenhouse gases is a natural process	91	28.44%	42	13.13%
	1,2	81	25.31%	47	14.69%
	1,2,3,4	0	0%	171	53.43%
2.10 Which are your sources of information regarding ‘climate change’?	TV and social media	93	29.06%	-	-
	Social media	129	40.31%	-	-
	Social media and magazines	98	30.63%	-	-

\* 1. Deforestation, 2. Increase in carbon emissions, 3. Industrial effluents, 4. Increase in population, 5. Urbanization

This table presents responses to several questions asked to study participants before and after the intervention.

- Awareness of climate change increased from 90.94% in the pre-test to 98.75% in the post-test.

- Understanding that climate and weather are different improved significantly, with the proportion answering "No" increasing from 9.06% (pre-test) to 81.88% (post-test).
- The perception of climate change as a global emergency saw a slight increase from 81.25% (pre-test) to 84.06% (post-test).
- More participants correctly identified various facets of climate change, with those recognizing temperature changes increasing from 24.38% (pre-test) to 73.44% (post-test).
- While before intervention, the knowledge regarding what causes climate change was mainly attributed to deforestation and increase in carbon emissions (51.56%), there was a uniform acceptance of 100% after the intervention that the reasons for climate change could be industrial effluents an increase in population and urbanization in addition to the above reasons.
- Awareness of greenhouse gases improved, with 100% of participants understanding the term post-test compared to 91.88% in pre-test.
- Recognizing of the impact of burning fossil fuels also changed, with the correct response on increased greenhouse gases rising from 20.00% in pre-test to 50.63% post-test.
- Knowing that life on earth is possible due to greenhouse effect was agreed upon by 68.12% of participants after the intervention as compared to 25.31% in the pre-test.

**Table 10: Comparison of Gender of study participants with baseline knowledge scores (N=320)**

Gender	Knowledge Score		Chi square	P value
	Poor Knowledge ( $<13.45$ )	Good Knowledge ( $\geq 13.45$ )		
Male (N=143)	76 (53.1%)	67 (46.9%)	0.831	0.362
Female (N=177)	85 (48%)	92 (52%)		

This table shows marginally higher percentage of female participants having baseline knowledge about climate change to be good (52%) when compared to male participants (46.9%). But there was no statistically significant association between gender and knowledge scores as shown by  $p > 0.05$ . This means that knowledge levels across males and females were similar about climate change.

**Table 11: Comparison of Residence of study participants with baseline knowledge scores (N=320)**

Residence	Knowledge Score		Chi square	P value
	Poor Knowledge (<13.45)	Good Knowledge ( $\geq$ 13.45)		
Urban (N=244)	121 (49.6%)	123 (50.4%)	0.214	0.643
Rural (N=76)	40 (52.6%)	36 (47.4%)		

The majority of the participants were from urban place of residence (n=244) and they scored slightly higher scores for knowledge assessment. But as the Chi-square value of 0.214 and p value of 0.643 suggests, living in urban or rural areas did not significantly impact baseline knowledge of participants regarding climate change.

**Table 12: Comparison of Course of study participants with baseline knowledge scores (N=320)**

Course	Knowledge Score		Chi square	P value
	Poor Knowledge ( $<13.45$ )	Good Knowledge ( $\geq 13.45$ )		
LLB (N=39)	23 (59%)	16 (41%)	1.876	0.599
BCA (N=90)	47 (52.2%)	43 (47.8%)		
B. Tech (N=110)	53 (48.2%)	57 (51.8%)		
B. Com (N=81)	38 (46.9%)	43 (53.1%)		

The above-mentioned table shows knowledge levels across various disciplines varied, but were not significantly different ( $p = 0.599$ ).

Students enrolled for LLB course had the lowest percentage of good knowledge (41%), whereas students pursuing a B. Com degree showed to have highest percentage of good knowledge scores (53.1%) among this study population about climate change.

**Table 13: Comparison of Socioeconomic Status of the study participants with baseline knowledge scores (N=320)**

SES (as per modified BG Prasad's Classification)	Knowledge Score		Chi square	P value
	Poor Knowledge (<13.45)	Good Knowledge ( $\geq$ 13.45)		
Class I (N=100)	47 (47%)	53 (53%)	0.963	0.915
Class II (N=78)	41 (52.6%)	37 (47.4%)		
Class III (N=63)	34 (54%)	29 (46%)		
Class IV (N=75)	37 (49.3%)	38 (50.7%)		
Class V (N=4)	2 (50%)	2 (50%)		

Knowledge scores among all SES groups were similar, with participants belonging to SES Class I showing the highest (53%). But in this study group, as shown by the Chi square value of 0.963 and p value of 0.915, there was no significant association between knowledge scores and socioeconomic status of the participants about climate change.

**Table 14: Descriptive analysis of knowledge score pre-test and post-test among study population (N=320)**

Parameter	Mean $\pm$ SD	Median	Minimum	Maximum
Knowledge Score Pre-test	13.45 $\pm$ 1.08	13.00	10.00	16.00
Knowledge Score Post-Test	17.04 $\pm$ 1.44	17.00	15.00	19.00

The mean knowledge score of study participants improved from 13.45 ( $\pm$ 1.08) in the pre-test to 17.04 ( $\pm$ 1.44) in the post-test. The median scores also increased from 13 to 17, with a minimum and maximum range shift from (10-16) to (15-19), showing an overall improvement in climate change knowledge of the study participants.

From this, we assume scores below the mean from the pre-test data to show poor knowledge and above the mean to be a good knowledge of participants.

#### **Effect size of the intervention on knowledge scores -**

To calculate the **effect size**, **Cohen's d** for effect size and **pooled standard deviation** for the calculation were employed.

#### **Step 1: Calculate Pooled Standard Deviation ( $SD_{pooled}$ )**

The formula for pooled standard deviation is:

$$SD_{pooled} = \sqrt{\frac{(n_1 - 1) \cdot SD_1^2 + (n_2 - 1) \cdot SD_2^2}{n_1 + n_2 - 2}}$$

Where:

- $n_1$  and  $n_2$  are the sample sizes for the two groups (pre-test and post-test) and in this case it is 320 each.
- $SD_1$  and  $SD_2$  are the two groups' standard deviations.

Given:

- **Pre-test:** Mean = 13.45, SD = 1.08
- **Post-test:** Mean = 17.04, SD = 1.44

Substituting these values,

$$\begin{aligned} S_p &= \sqrt{\frac{(320 - 1)(1.08^2) + (320 - 1)(1.44^2)}{320 + 320 - 2}} \\ &= \sqrt{\frac{319 \times 1.1664 + 319 \times 2.0736}{320 + 320 - 2}} \\ &= \sqrt{1.6196} \end{aligned}$$

Hence,  $SD_{\text{pooled}} = 1.27$

### Step 2: Calculate Cohen's d (Effect Size)

$$d = \frac{M_2 - M_1}{SD_{\text{pooled}}}$$

where:

- $M_2 = 17.04$  (Post-test mean)
- $M_1 = 13.45$  (Pre-test mean)

When computing these values,

$$\begin{aligned} d &= \frac{17.04 - 13.45}{1.27} \\ &= 2.84 \end{aligned}$$

- **Pooled Standard Deviation ( $SD_{\text{pooled}}$ ): 1.27**
- **Cohen's d (Effect Size): 2.82**

This indicates a **very large effect size**, suggesting a strong improvement in knowledge scores from pre-test to post-test of the participants about climate change.

**Table 15: Positive questions of Attitude Towards Climate Change in pre and post-test (n=320)**

	Positive Questions	Pre-test Response		Post test Response	
		Yes	No	Yes	No
3.1	“Human actions are a cause for climate change.”	281 (87.81%)	39 (12.19%)	230 (71.88%)	90 (28.13%)
3.2	“India is a major contributor to global climate change.”	99 (30.94%)	221 (69.06%)	185 (57.81%)	135 (42.19%)
3.3	“Climate change is affecting Karnataka state.”	99 (30.94%)	221 (69.06%)	76 (23.75%)	244 (76.25%)
3.4	“People need more information about climate change.”	191 (59.69%)	129 (40.31%)	228 (71.88%)	92 (28.75%)
3.5	“Climate change education should be part of every study curriculum”	185 (57.81%)	135 (42.19%)	320 (100%)	0 (0%)
3.6	“Radiations increase the hole of the ozone layer of earth.”	146 (45.63%)	174 (54.38%)	99 (30.94%)	221 (69.06%)
3.7	“Climate change has a harmful effect on water supply.”	221 (69.06%)	99 (30.94%)	238 (74.38%)	82 (25.63%)
3.8	“Waste recycling practices help decrease impact of climate change.”	99 (30.94%)	221 (69.06%)	320 (100%)	0 (0%)
3.9	“Global warming is both a current and future generation problem.”	238 (74.38%)	82 (25.63%)	230 (71.88%)	90 (28.13%)
3.10	“Individuals and the government are both equally responsible to tackle climate change.”	146 (45.63%)	174 (54.38%)	320 (100%)	0 (0%)
3.11	“Renewable energy sources the solution for global warming”	230 (71.88%)	90 (28.13%)	228 (71.25%)	92 (28.75%)
3.12	“All equipment/technology/vehicles with renewable sources of energy are expensive”	228 (71.25%)	92 (28.75%)	53 (16.56%)	267 (83.44%)
3.13	“Garbage disposal is not done well by the authorities of my house locality.”	126 (39.38%)	194 (60.63%)	0 (0%)	320 (100%)
3.14	“I would get an electric vehicle over a diesel/petrol vehicle if given the choice.”	0 (0%)	320 (100%)	191 (59.69%)	129 (40.31%)

In the pre-test, **87.81%** of participants agreed that “*human actions are a cause for climate change*”, but this dropped to **71.88%** in the post-test, indicating a decrease in agreement. Conversely, the belief that “*India is a major contributor to global climate change*” increased from **30.94%** (pre-test) to **57.81%** (post-test), showing a rise in awareness about the country’s role in global emissions.

When asked whether '*climate change is affecting Karnataka state*', **30.94%** of participants agreed in the pre-test, but this dropped slightly to **23.75%** post-test. Meanwhile, the percentage of those who believed '*people need more information about climate change*' increased from **59.69%**(pre-test) to **71.88%** (post-test), suggesting greater recognition of the need for education on this topic.

A major shift was seen in the question regarding *climate change education should be a part of the study curriculum*, where agreement increased from **57.81%** in the pre-test to **100%** post-test. Similarly, the perception that *waste recycling practices help decrease the impact of climate change* also rose from **30.94%** (pre-test) to **100%** post-test.

On the topic of the *harmful effects of climate change on water supply*, agreement increased from **69.06%** (pre-test) to **74.38%** (post-test), while the belief that *radiation increases the hole in the ozone layer* decreased from **45.63%** (pre-test) to **30.94%** (post-test), possibly indicating improved understanding of climate science.

Regarding personal action, in the pre-test, **none** of the participants said they would choose an *electric vehicle over a diesel or petrol vehicle*, but this increased significantly to **59.69%** post-test. Similarly, the belief that *individuals and the government are equally responsible for tackling climate change* rose from **45.63%** (pre-test) to **100%** (post-test).

A notable decrease was observed in the belief that *all equipment/technology/vehicles with renewable sources of energy are expensive*, which dropped from **71.25%** in the pre-test to **16.56%** post-test, suggesting an improved perception of renewable energy affordability.

**Table 16: Negative questions of Attitude Towards Climate Change in pre and post-test (n=320)**

	Negative Questions	Pre-test Response		Post test Response	
		Yes	No	Yes	No
3.15	“We are too small to do anything about climate change.”	35 (10.94%)	285 (89.06%)	0 (0%)	320 (100%)
3.16	“I would only do my bit to reduce climate change if everyone else did as well”	205 (64.06%)	115 (35.94%)	0 (0%)	320 (100%)
3.17	“All equipment/technology/vehicles with renewable sources of energy are expensive”	294 (91.88%)	26 (8.13%)	129 (40.31%)	191 (59.69%)
3.18	“Maintaining economic growth is more important than protecting the environment”	191 (59.69%)	129 (40.31%)	36 (11.25%)	284 (88.75%)
3.19	“Nature is strong enough to cope with the impact of modern industrial nations”	292 (91.25%)	28 (8.75%)	129 (40.31%)	191 (59.69%)
3.20	“People adapt enough nature-based solutions or alternatives to combat climate change”	191 (59.69%)	129 (40.31%)	63 (19.69%)	257 (80.31%)
3.21	“I do not believe climate change is a real problem.”	197 (61.56%)	123 (38.44%)	32 (10%)	288 (90%)

The statement *"We are too small to do anything about climate change"* saw 10.94% agreement in the pre-test, but post-test, none of the participants agreed, indicating a stronger belief in individual action. Similarly, agreement with *"I would only reduce climate change if everyone else did as well"* dropped from 64.06% in the pre-test to 0% in the post-test, showing a shift towards personal responsibility.

The belief that *'all equipment/technology/vehicles with renewable sources of energy are expensive'* dropped sharply from 91.88% pre-test to 40.31% post-test, indicating an improved

understanding of affordability in renewable energy solutions. Likewise, agreement with *'Maintaining economic growth is more important than protecting the environment'* fell from 59.69% (pre-test) to 11.25% (post-test), reflecting a greater emphasis on environmental protection.

In the pre-test, 91.25% of participants agreed with the statement *'Nature is strong enough to cope with the impact of modern industrial nations.'* However, this number fell to 40.31% post-test, suggesting a stronger recognition of human impact on nature.

Agreement with the idea that *'People adapt enough nature-based solutions or alternatives to combat climate change'* dropped from 59.69% (pre-test) to 19.69% (post-test), indicating a realization that current solutions may not be sufficient. Similarly, the belief that *'Climate change is not a real problem'* decreased from 61.56% pre-test to 10% post-test, highlighting a reduction in climate change scepticism among the participants.

**Table 17: Effect size of changes in positive attitudes towards climate change among participants**

	<b>Statement</b>	<b>Cohen's w</b>	<b>Effect Size Interpretation</b>
3.1	"Human actions are a cause for climate change."	0.22	Small
3.2	"India is a major contributor to global climate change."	0.4	Large
3.3	"Climate change is affecting Karnataka state."	0.13	Small
3.4	"People need more information about climate change."	0.21	Small
3.5	"Climate change education should be part of every study curriculum"	0.61	Large
3.6	"Radiations increase the hole of the ozone layer of earth."	0.26	Medium
3.7	"Climate change has a harmful effect on water supply."	0.14	Small
3.8	"Waste recycling practices help decrease impact of climate change."	0.5	Large
3.9	"Global warming is both a current and future generation problem."	0.07	Small
3.10	"Individuals and the government are both equally responsible to tackle climate change."	0.58	Large
3.11	"Renewable energy sources are the solution for global warming"	0.04	Small
3.12	"All equipment/technology/vehicles with renewable sources of energy are expensive"	0.48	Large
3.13	"Garbage disposal is not done well by the authorities of my house locality."	0.55	Large
3.14	"I would get an electric vehicle over a diesel/petrol vehicle if given the choice."	0.61	Large

Cohen's  $w$  (Chi-square Effect Size) was calculated for categorical data comparisons between pre-test and post-test response proportions for each statement.

- Statements with larger effect sizes indicate a significant shift in positive attitude due to the intervention.
- Some statements saw increased agreement, suggesting improved awareness and indicating a shift in understanding about climate change.

**Table 18: Effect size of changes in negative attitudes towards climate change among participants**

	<b>Statement</b>	<b>Cohen's w</b>	<b>Effect Size Interpretation</b>
3.15	"We are too small to do anything about climate change."	0.32	Medium
3.16	"I would only do my bit if others did as well."	0.5	Large
3.17	"All equipment/technology/vehicles with renewable sources of energy are expensive"	0.45	Large
3.18	"Maintaining economic growth is more important than protecting the environment"	0.55	Large
3.19	"Nature is strong enough to cope with the impact of modern industrial nations"	0.5	Large
3.20	"People adapt enough nature-based solutions or alternatives to combat climate change"	0.46	Large
3.21	"I do not believe climate change is a real problem."	0.53	Large

- A strong effect size in reducing negative attitudes among study participants indicated a successful intervention.
- Large shifts in statements like "climate change is not a real problem" and a strong shift in the disagreement to the statement "Maintaining economic growth is more important than protecting the environment" showed increased climate change awareness among the study participants after intervention.

Table 19: Practices of study participants towards Climate Change (n=320)

	Practices of study participants	Pre-test response		Post-test response	
		Yes	No	Yes	No
4.1	“I spend more on environment friendly products like recyclable bags, CFLs, bamboo utensils etc.”	30 (9.38%)	290 (90.63%)	254 (79.38%)	66 (20.63%)
4.2	“I consciously reduce the use of plastics.”	311 (97.19%)	9 (2.81%)	250 (78.13%)	70 (21.88%)
4.3	“I recycle and reuse whenever possible.”	294 (91.88%)	26 (8.13%)	261 (81.56%)	59 (18.44%)
4.4	“I planted a sapling in the last 6 months.”	32 (10%)	288 (90%)	250 (78.13%)	70 (21.88%)
4.5	“I use a solar water heater/ cooker.”	5 (1.56%)	315 (98.44%)	27 (8.44%)	293 (91.56%)
4.6	“I car pool (share) travel with friends.”	307 (95.94%)	13 (4.06%)	307 (95.94%)	13 (4.06%)
4.7	“I have reduced consumption of <b>OR</b> quit <b>OR</b> do not follow a non-vegetarian diet.”	255 (79.69%)	65 (20.31%)	320 (100%)	0 (0%)
4.8	“I use public transportation to save fuel.”	250 (78.13%)	70 (21.88%)	257 (80.31%)	63 (19.69%)
4.9	“I use energy saving appliances.”	197 (61.56%)	123 (38.44%)	261 (81.56%)	59 (18.44%)
4.10	“I turn off lights/devices when not in use.”	22 (6.88%)	298 (93.13%)	257 (80.31%)	63 (19.69%)
4.11	“I have separate bins for recyclable waste.”	32 (10%)	288 (90%)	255 (79.69%)	65 (20.31%)
4.12	“I go for prints when I already have soft copies of documents.”	256 (80%)	64 (20%)	27 (8.44%)	293 (91.56%)
4.13	“I keep appliances <b>OR</b> phones for charging overnight.”	32 (10%)	288 (90%)	258 (80.63%)	62 (19.38%)

4.14	“Climate change is a common topic of conversation among my friends and family.”	262 (81.88%)	58 (18.13%)	310 (96.88%)	10 (3.13%)
4.15	“I donated my clothes in the past year.”	311 (97.19%)	9 (2.81%)	256 (80%)	64 (20%)

A significant increase was observed in the number of participants who reported ‘*spending more on environment-friendly products like recyclable bags, CFLs, and bamboo utensils*’, rising from **9.38%** in the pre-test to **79.38%** post-test. Similarly, those who had ‘*planted a sapling in the last six months*’ increased dramatically from **10%** in the pre-test to **78.13%** post-test.

A major change was seen in the practice of ‘*turning off lights and devices when not in use*’, which increased from **6.88%** pre-test to **80.31%** post-test. Additionally, ‘*separating waste into recyclable bins*’ saw a substantial rise, from **10%** (pre-test) to **79.69%** (post-test).

Regarding diet, **79.69%** of participants in the pre-test stated that they had ‘*reduced consumption of or quit non-vegetarian food*’, which increased to **100%** post-test. ‘*Using energy-saving appliances*’ also saw a major increase, from **61.56%** (pre-test) to **81.56%** (post-test).

Some declines were observed as well. The number of participants who reported ‘*consciously reducing plastic use*’ decreased from **97.19%** to **78.13%** (post-test), while ‘*donating clothes in the past year*’ dropped from **97.19%** (pre-test) to **80%** post-test.

The number of participants who said ‘*climate change is a common topic of conversation among their friends and family*’ increased from **81.88%** pre-test to **96.88%** post-test, indicating a rise in climate discussions.

Interestingly, ‘*going for printouts when soft copies are available*’ dropped from **80%** pre-test to **8.44%** post-test, suggesting a significant reduction in paper usage.

Overall, most climate-friendly practices saw substantial improvements, with a few minor declines in areas where pre-test participation was already high were observed.

**Table 20: Descriptive analysis of reasons for sustainable practices among the study population (N=320)**

<b>Reasons for practices (Pre-test)</b>	<b>Frequency</b>	<b>Percentages</b>
3,4	128	40.00%
3,5	111	34.69%
4,5	81	25.31%
<b>Reasons for practices (Post-test)</b>	<b>Frequency</b>	<b>Percentages</b>
2,3,4,5	66	20.63%
2,3,4,5,6	60	18.75%
3,4	49	15.31%
3,4,5	69	21.56%
3,4,5,6	76	23.75%

\* 1. Convenience, 2. To save money, 3. To protect the environment, 4. For my health, 5. Habit, 6. Moral obligation

- Pre-test responses were mostly concentrated in three categories (3,4: **40.00%**; 3,5: **34.69%**; 4,5: **25.31%**), which corresponded to protection of the environment, for health and out of habit as the main reasons why participants carried out climate sensitive practices.
- Post-test responses were diversified, with the highest response in the **3,4,5,6 category (23.75%)**, which added convenience, saving money and also moral obligation as reasons for their practices, which indicated a broader understanding of reasons for sustainable practices among the study participants.

**Table 21: Effect size of changes in climate sensitive practices towards climate change**

	<b>Practice</b>	<b>Cramér's V</b>	<b>Interpretation</b>
4.1	Spending more on environment-friendly products	0.701	Strong positive association
4.2	Consciously reducing the use of plastics	0.285	Weak negative association
4.3	Recycling and reusing	0.147	Weak negative association
4.4	Planting a sapling in the last 6 months	0.683	Strong positive association
4.5	Using a solar water heater/cooker	0.151	Moderate positive association
4.6	Car-pooling	0	No change
4.7	Reducing or quitting non-vegetarian diet	0.331	Complete adoption
4.8	Using public transport to save fuel	0.023	Minimal positive association
4.9	Using energy-saving appliances	0.218	Moderate positive association
4.10	Turning off lights/devices when not in use	0.737	Strong positive association
4.11	Having separate bins for recyclable waste	0.697	Strong positive association
4.12	Avoiding unnecessary printouts of documents	0.717	Strong negative association
4.13	Charging appliances/phones overnight	0.706	Strong positive association
4.14	Discussing climate change with friends and family	0.238	Moderate positive association
4.15	Donating clothes in the past year	0.265	Weak negative association

The table provides Cramer's V values for various climate-sensitive practices, along with their interpretations. The table shows:

#### **Strong Associations (Cramer's V > 0.5)**

Practices with strong positive associations indicate a high likelihood of being influenced by climate change awareness. These include:

- **Spending more on environment-friendly products (Cramer's V = 0.701):** Individuals sensitive to climate change are significantly more likely to invest in eco-friendly products.

- **Planting a sapling in the last 6 months (Cramer's V = 0.683):** This practice shows a strong link to climate change sensitivity, suggesting it is a common response to environmental awareness.
- **Turning off lights/devices when not in use (Cramer's V = 0.737):** This energy-saving behaviour is strongly associated with climate change awareness, making it a widely adopted practice.
- **Having separate bins for recyclable waste (Cramer's V = 0.697):** The strong positive association indicates that waste segregation is closely tied to climate change sensitivity.
- **Charging appliances/phones overnight (Cramer's V = 0.706):** This practice also shows a strong association, suggesting it is influenced by climate change awareness.
- **Avoiding unnecessary printouts (Cramer's V = 0.717):** Interestingly, this practice shows a strong *negative* association, implying that individuals sensitive to climate change are less likely to avoid printouts, possibly due to other factors like convenience or necessity.

These practices are highly effective in reflecting climate change sensitivity and are likely to be prioritized by environmentally conscious individuals.

#### **Moderate Associations ( $0.3 \leq \text{Cramer's } V < 0.5$ )**

Practices with moderate associations show some link to climate change sensitivity but are not as strongly adopted as those with higher Cramer's V values. These include:

- **Using a solar water heater/cooker (Cramer's V = 0.151):** While the association is positive, it is only moderate, indicating partial adoption among climate-sensitive individuals.
- **Using energy-saving appliances (Cramer's V = 0.218):** This practice shows a moderate link to climate change awareness, suggesting it is adopted by some but not all environmentally conscious individuals.
- **Discussing climate change with friends and family (Cramer's V = 0.238):** The moderate association indicates that climate change discussions are somewhat linked to awareness but may not be a universal behaviour.
- **Reducing or quitting non-vegetarian diet (Cramer's V = 0.331):** This practice shows a moderate association, suggesting partial adoption in response to climate change concerns.

These practices reflect a middle ground, where climate change awareness influences behaviour to some extent, but other factors may also play a role.

---

**Weak Associations (Cramer's  $V < 0.3$ )**

Practices with weak associations were not strongly influenced by climate change awareness.

These include:

- **Consciously reducing the use of plastics (Cramer's  $V = 0.285$ ):** The weak negative association suggests that this practice is not strongly linked to climate change sensitivity.
- **Recycling and reusing (Cramer's  $V = 0.147$ ):** This practice shows a weak negative association, indicating it is not widely adopted in response to climate change.
- **Using public transport to save fuel (Cramer's  $V = 0.023$ ):** The minimal positive association suggests that this practice is not strongly influenced by climate change awareness.
- **Donating clothes in the past year (Cramer's  $V = 0.265$ ):** The weak negative association indicates that this practice is not strongly linked to climate change sensitivity.
- **Carpooling (Cramer's  $V = 0$ ):** No association indicates that this practice is unrelated to climate change awareness.

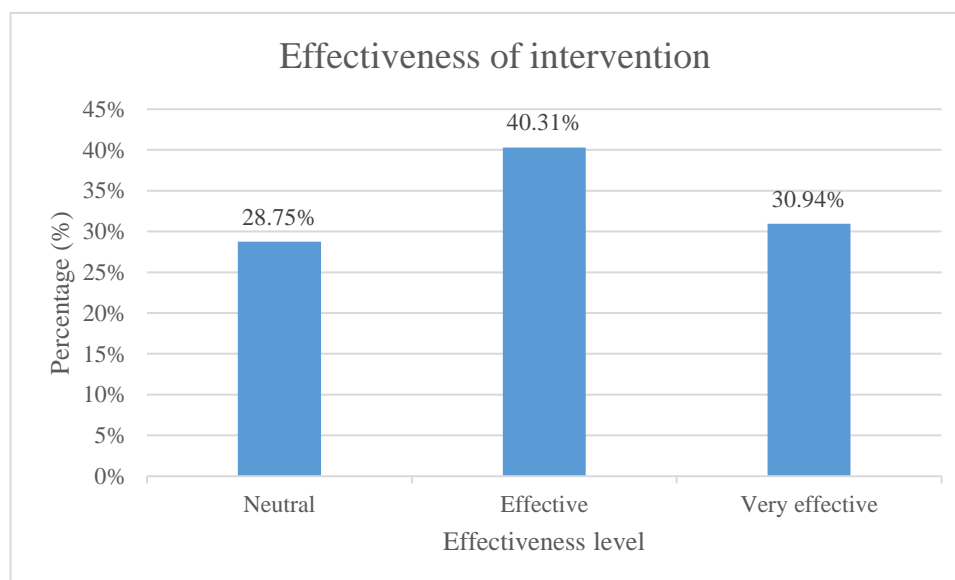
These practices are either not widely adopted in response to climate change or are influenced by other factors beyond environmental awareness among the study participants.

**Table 22: Feedback on how effective the intervention was during post-test in the study population (N=320) compared to pre-test**

Effectiveness of intervention practices (post-test)	Frequency	Percentages
Neutral	92	28.75%
Effective	129	40.31%
Very effective	99	30.94%

- **40.31%** of the study participants rated the intervention as ‘**Effective**’, while **30.94%** rated it as ‘**Very Effective**’, suggesting a generally positive reception to the intervention.

**Fig.9: Bar graph showing perceived effectiveness of overall interventional programme**



## QUALITATIVE ANALYSIS

### **Theme 1 - Sustainability and Environmental Conservation**

One of the predominant themes that emerged from the students' responses was the emphasis on sustainability and environmental conservation. Many participants expressed the importance of adopting eco-friendly habits in daily life.

P184-T2 shared, "*Encourage more walking or cycling, instead of taking a mode of transportation. Planting a sapling, at least on your birthdays every year or um, as a mark of remembrance.*" This highlights the growing awareness among students about adopting sustainable practices and integrating them into personal and community routines. Such small-scale individual efforts contribute significantly to the larger goal of mitigating climate change.

Other responses further emphasized sustainability initiatives, such as reducing fossil fuel usage and promoting renewable energy. P092-T1 noted, "*Switching to solar energy for our home's electricity needs has significantly reduced our carbon footprint and saved on energy bills. The initial investment was quite high but we got a lot of subsidies from the government.*" This illustrates the dual benefits of sustainable solutions—environmental impact and financial savings—which could further encourage adoption among communities.

P307-T2 stated, "*I've started using a bamboo toothbrush to reduce plastic waste. It's a small change, but it feels good to contribute. I have also switched to using LED bulbs in my room. They consume less energy and last longer.*" This response demonstrates individual willingness to adopt environmentally friendly practices.

## **Theme 2 - Policy Action and Government Responsibility**

Students also highlighted the role of government in addressing climate change, advocating for stricter policies and better implementation of existing schemes.

P025-T1 observed, "*There are already many schemes and actions taken by the government. There's just a need to make it more disciplinary mandatory and certain actions should be taken up by both the government and citizens.*" This suggests that while policies exist, there is a gap in enforcement and citizen participation.

Additionally, there were calls for better incentives and penalties to drive eco-friendly behaviour. P216-T2 stated, "*Subsidies and incentives for eco-friendly products can motivate more people to adopt sustainable living practices.*" This aligns with global best practices where financial motivators often lead to increased participation in environmental initiatives.

P143-T1 suggested, "*The government should make it mandatory for colleges to have solar panels on rooftops. It would reduce energy costs and promote renewable energy.*"

Another policy recommendation, as mentioned by P078-T2, was, "*The government should provide free or subsidized public transport for students to reduce the number of private vehicles on the road.*" This response highlights a practical and thoughtful way of reducing carbon emissions through vehicles.

### **Theme 3 - Waste Management and Recycling**

Waste management emerged as a key concern, with students discussing personal efforts and community-driven initiatives to reduce waste.

P312-T1 reflected on the severity of improper waste disposal, stating, "*I saw social media posts showing places in India where there is no waste disposal. This was done through Google Maps with geo-tagged photos. If this is being taken up, just imagine how bad our waste-throwing and recycling practices are.*" This highlights the growing role of digital tools in environmental awareness and the pressing need for better waste disposal systems.

Other students gave descriptions of their own contributions, such as making doormats from plastic bags and composting kitchen waste. P054-T2 emphasized, "*Instead of throwing away old clothes, I now donate them or repurpose them into household items like cleaning rags.*" Such actions reflect a cultural shift towards sustainability and the increasing role of upcycling in waste management.

On the same topic, P298-T1 noted, "*I've started upcycling old clothes into trendy outfits instead of throwing them away. It's fun and eco-friendly.*" This response shows how students can transform seemingly mundane actions into enjoyable and sustainable lifestyle choices.

#### **Theme 4 - Education and Awareness**

Several responses emphasized the need for education as a key tool in fostering environmental responsibility.

P162-T2 stated, "*Schools and colleges should take serious measures and activities based on the environment and protection of them.*" This suggests that early intervention through education can instil lifelong sustainable habits.

Social media was also mentioned as a powerful tool in spreading awareness. P087-T1 remarked, "*Social media campaigns can play a crucial role in spreading awareness about sustainable habits and eco-friendly alternatives. I had registered for a march to highlight environmental sustainability and that session taught me a lot.*" This highlights the potential of digital platforms in mobilizing youth action towards climate change.

There were times when students took up initiatives independently. P221-T2 shared, "*I've started a social media page to share tips on sustainable living. It's a great way to spread awareness among my peers.*" This showcases how youth, empowered with knowledge, can become role models for change.

### **Theme 5 - Personal Responsibility and Community Efforts**

Finally, students recognized the impact of individual actions and community efforts in fostering environmental consciousness.

P074-T1 expressed, "*The main thing I did was I did not burst any crackers during festivals. Me and my family also took up this initiative on ourselves.*" This reflects a growing shift in traditional cultural practices towards more sustainable alternatives.

P209-T2 shared, "*I have encouraged my neighbours to plant more trees in our locality, and together we have created a small community garden.*" This illustrates how small personal efforts, when collectively undertaken, can contribute significantly to environmental conservation.

There were also instances where individuals encouraged their peers to adopt lifestyle changes. P141-T1 noted, "*I've convinced my roommates to switch to eco-friendly cleaning products. It's better for the environment and our health.*"



## Detailed Interpretation of the Word Cloud

### 1. Major Themes and Focus Areas

The most prominent words in the cloud indicate the main areas of concern and action among respondents.

- **"Waste," "Recycling," "Plastic," and "Reduce"**  
These words suggest that many responses focused on waste management, particularly reducing and recycling waste materials. Plastic waste appears to be a significant concern, which aligns with global discussions on plastic pollution and its environmental impact.
- **"Government," "Policies," "Incentives," and "Subsidies"**  
Many respondents seem to believe that government intervention is crucial for environmental improvement. This could involve policies promoting sustainability, incentives for eco-friendly behaviours, or subsidies for green initiatives such as renewable energy and composting programs.
- **"Sustainability," "Environmental," "Eco-friendly," and "Community"**  
These words emphasize the broader concern for long-term sustainability and environmental responsibility. The presence of "Community" suggests that collective action and local initiatives are seen as effective ways to drive change.
- **"Energy," "Carbon," "Biogas," and "Biofuel"**  
These words indicate discussions about renewable energy sources and reducing carbon emissions. "Biogas" and "Biofuel" suggest that some respondents may have engaged in or recommended alternative energy sources to reduce reliance on fossil fuels.
- **"Planting," "Greenery," and "Cloth"**  
"Planting" and "Greenery" suggest that many individuals engage in tree planting or gardening as part of their eco-friendly activities. "Cloth" may indicate a focus on sustainable fashion, reducing textile waste, or promoting reusable cloth bags instead of plastic ones.

## 2. Behavioural and Social Aspects

- **"Encourage," "Awareness," and "Education"**  
These words highlight the importance of spreading knowledge and promoting environmentally friendly attitudes. Many respondents likely suggested education-based initiatives to encourage sustainable behaviours.
- **"Transportation," "Cycling," and "Driving"**  
Transportation choices play a role in sustainability. The mention of "Cycling" suggests that some respondents use bicycles instead of cars to reduce their carbon footprint. "Driving" may relate to suggestions for reducing car usage, carpooling, or switching to electric vehicles.
- **"Initiatives," "Activities," and "Practices"**  
These words suggest that many respondents proposed specific actions or programs to support environmental sustainability.
- **"Compostable," "Alternatives," and "Products"**  
These words indicate a focus on biodegradable products and sustainable alternatives. Many respondents likely mentioned composting as an eco-friendly practice.

## **DISCUSSION**

### **Table 1: Descriptive analysis of age in the study population**

Our study population had a young demographic, with a mean age of  $20.54 \pm 1.75$  years and a fairly uniform age distribution among 18 to 23-year-olds. A European Investment Bank survey done in 2023 among 30,000 participants in the European Union found that respondents over 30 scored higher in understanding climate change causes and consequences compared to those under 30.<sup>54</sup> Additionally, 74% of over-30s recognized the importance of recycling, versus 66% of younger respondents, and 48% acknowledged the role of better-insulated buildings in combating climate change, compared to 30% of younger individuals.<sup>54</sup> Similarly, a separate study done in 2022, assessing global warming knowledge in Egypt among 527 participants, found that individuals over 30 demonstrated statistically higher knowledge levels, with factors like marital status, urban residency, higher education, and employment positively correlating with climate change awareness.<sup>55</sup> Comparing to our younger study population, it is likely that participants may have had less exposure to climate change education and fewer real-world experiences that shape environmental awareness.

### **Table 2: Distribution of study participants according to gender**

Our study, which involved 320 participants in India (55.31% female, 44.69% male), revealed that, despite there being no statistically significant difference ( $p > 0.05$ ), 52% of females had high baseline knowledge compared to 46.9% of males. Though statistical significance was not observed, a study conducted in the United States of America in 2018 among 280 participants revealed that female and physician assistant students were more dedicated to tackling pollution and climate change than male and medical students.<sup>45</sup> These discrepancies might result from cultural factors, healthcare sustainability awareness, and variances in climate education. The U.S. study indicated a difference in involvement levels,<sup>45</sup> despite the fact that our study did not find any gender-based differential in climate knowledge. This underscores the necessity for focused instruction on environmental sustainability in healthcare curriculum across various locations.

**Table 3: Distribution of study participants according to enrolled course**

Our study's participants were found to have a Bachelor of Technology as their primary qualification (34.3%), followed by a Bachelor's in Computer Applications (28.1%), Commerce (25.4%), and Legislative Law (12.2%). This data is consistent with evidence showing that undergraduate students focus on a range of climate change knowledge, and that this focus often stems from the structure of the program of study and major field of attention. There is evidence that non-engineering students can be successfully taught climate understanding through structured education interventions like course design that features game based and other engaging virtual reality techniques.<sup>56</sup> On the other hand, while engineering and technology students are mostly receivers of training, the level to which climate change is taught may be poor unless it is made clearly explicit in the curriculum. With this information, institutions such as the University of California, San Diego, USA, have started offering compulsory courses on climate change for all courses so that all students are taught the basics of climate science, the impact of people, and ways to mitigate climate change.<sup>57</sup> Other colleges, such as San Francisco State University, USA, have also moved to a position from where all students are permitted and even required to take a course on miracles known as climate justice for all students regardless of discipline.<sup>58</sup> From the distribution of participants in our study, it seems certain that climate knowledge levels may differ based on course background, with students in law and commerce potentially having less exposure to climate science. This underscores the need for universities to incorporate climate education into all undergraduate programs, ensuring that students across diverse fields develop an informed perspective on climate change and its societal implications. This aspect is already being implemented as the University Grants Commission (UGC) of India has made it mandatory for all undergraduate courses to have a course on Environmental studies in the course curriculum.<sup>59</sup>

**Table 4: Residence Distribution of study participants**

Most of the participants that took part in this study were from urban areas (76.25%), while 23.75% resided in rural areas. This urban predominance may have influenced the findings, particularly in terms of climate awareness and engagement in sustainable practices. The study by UNICEF done in Sweden in 2022 among 1348 participants found that urban populations generally have better exposure to environmental education and sustainable initiatives compared to rural populations.<sup>33</sup> Similarly, the systematic review on climate education effects highlighted that urban students had a 30% improvement in knowledge scores compared to their rural counterparts, likely due to increased access to experiential learning and interactive educational materials.<sup>29</sup> The observed results, though not statistically significant, align with these findings, as urban students may have greater exposure to media campaigns, workshops, and discussions on climate change.

**Table 5: Income and Per Capita Income (PCI)**

Our study participants displayed a wide range of income levels, with a mean monthly income of 13,678.13 INR and a PCI mean of 2,860.89 INR. Financial status can play a critical role in sustainable behaviours, as evidenced by the study done in Canada in 2022 among 200 students that found students from higher-income backgrounds were more likely to adopt sustainable behaviours post-intervention.<sup>28</sup> However, the UNDP study in Grenada of 2016 among 519 participants indicated that even those from lower-income backgrounds strongly supported the integration of climate change education into curricula.<sup>34</sup> This suggests that while financial constraints can impact access to resources like renewable energy solutions, consciousness and readiness to participate in sustainable behaviours can exist across all income levels.

**Table 6: Descriptive analysis of family size in the study population**

There is barely any research on the connection between household size and climate change awareness. Existing research, however, indicates that household size may have an impact on attitudes and ability to adapt to climate change. Larger households, for example, can be more vulnerable to the effects of climate change because of resource limitations, which could have an impact on their environmental awareness and responsiveness. On the other hand, smaller households may have higher carbon emissions per capita, which may affect how well they comprehend and apply mitigation techniques for climate change. To directly evaluate the impact of household size on climate change understanding and responses, more study is required.

**Table 7: Descriptive analysis of SES in the study population**

In our study, participation from lower and middle SES categories was markedly less compared to the upper strata, with most respondents belonging to SES I (31.25%), SES II (24.38%), SES IV (23.44%), SES III (19.69%), and just 1.25 percent of them in SES V as evident from the figure. This pattern is consistent with other studies that note that those with higher socioeconomic statuses (SES) tend to have better information access and resources, which enables them to participate in climate conversations and policies.<sup>60</sup> It has been observed that higher-SES individuals are having greater awareness of climate change due to the fact that they have better access to education and reliable information.<sup>61</sup> On the other hand, lower SES groups are often more vulnerable to the impacts of climate change, yet they tend to have fewer resources and less education to actually combat climate change.<sup>62</sup> In addition, this gap is exacerbated by other socioeconomic dimensions such as access and availability of information and communication technology covering a person's adaptive capacity to climate changes.<sup>61</sup> Out of all the categories, the lowest SES did not seem to participate at all which adds to the notion that climate change knowledge was relatively higher, within our sample, than would be encountered in a more socio-economically dispersed sample.

**Table 8: Descriptive analysis of category in the study population**

Our analysis showed that the majority of respondents fell within the General category 85.63%, SC/ST participants totalled 13.75% and the OBC category had the least representation of 0.63%. This distribution is valid within the scope of adaptive knowledge and strategies of climate change since literature proves that certain marginalized groups especially SCs and STs are economically disadvantaged and, therefore, more vulnerable to the impacts of climate changes.<sup>63</sup> Research in India suggests that the Scheduled Castes (SC) and Scheduled Tribes (ST) groups as defined in the constitution, living in drought prone areas have the poorest coping mechanisms which, as suggested, indicate a lack of accessibility to climate information for the General category.<sup>63</sup> Moreover, people belonging to socially disadvantaged castes are increasingly more likely to be climate change migrants which show some differential knowledge and responsiveness to climate change impacts mediated by social class.<sup>64</sup> Based on what was already reported, participants of the study are believed to have possessed a higher overall knowledge on the course of climate change with the General category participants owing to better educational and resource access. However, the smaller representation of SC/ST and OBC participants suggests that their perspectives and challenges related to climate change may not be fully captured. This underscores the importance of inclusive climate education and resource distribution strategies that address socio-cultural disparities to ensure equitable climate awareness and resilience-building across all social categories in India.

**Table 9: Knowledge about Climate Change (Pre-test and Post-Test) among study participants.**

A significant increase in climate change awareness was observed post-intervention, with knowledge about climate change rising from 90.94% to 98.75%. Similarly, comprehension of the greenhouse effect and the role of fossil fuels improved markedly. These findings align with the Canadian sustainability intervention study done in 2022 among 200 participants, which reported a 25% increase in knowledge scores post-intervention.<sup>28</sup> Furthermore, the Ghana study of 2023 done amongst 50,004 participants found that students who attended climate workshops had 1.5 times better awareness than those who did not.<sup>27</sup> The consistency between these studies and our findings reinforces the effectiveness of structured educational interventions in improving climate literacy.

**Table 10: Comparison of gender of study participants with baseline knowledge scores about climate change**

The results indicate that female participants demonstrated slightly higher baseline knowledge about climate change compared to male participants. However, the lack of statistical significance ( $p > 0.05$ ) suggests that gender does not play a decisive role in determining knowledge levels. This finding aligns with the study conducted in Ghana<sup>27</sup>, which reported that females exhibited more knowledge gaps despite showing higher engagement. Similarly, the systematic review<sup>29</sup> done in 2023 found that girls demonstrated a 15% higher behavioural change rate than boys, suggesting that while gender differences may not be evident in knowledge levels, they might influence subsequent engagement and behaviour.

**Table 11: Comparison of residence of study participants with baseline knowledge scores about climate change.**

Although participants from urban areas had slightly higher knowledge scores than those from rural areas, there was no statistically significant difference ( $p = 0.643$ ). This finding contradicts the study conducted in 2016 among 519 participants in Grenada,<sup>34</sup> where individuals with higher education, typically associated with urban settings, showed better climate change awareness. However, it aligns with findings from the study in 2021 at Karimnagar among 903 participants, which showed that mere knowledge of climate change does not necessarily translate into proactive behaviour.<sup>36</sup>

**Table 12: Comparison of educational course of study participants with baseline knowledge scores about climate change.**

The study revealed that B. Com students had the highest proportion of good knowledge scores (53.1%), while LLB students had the lowest (41%). The lack of statistical significance ( $p = 0.599$ ) suggests that course specialization does not significantly affect knowledge levels. This finding resonates with the study from Mangalore, India done in 2016 among 375 students, which reported differences in practices rather than knowledge between science and non-science students, indicating that specific curricula might not inherently impact climate change awareness.<sup>38</sup>

**Table 13: Comparison of Socioeconomic Status (SES) of study participants with baseline knowledge scores about climate change.**

Participants from higher socioeconomic backgrounds (Class I) showed the highest percentage of good knowledge scores (53%), but SES was not a significant factor ( $p = 0.915$ ). This is consistent with findings from the UNDP Grenada study of 2016<sup>34</sup>, which highlighted that education level rather than socioeconomic background influenced climate change awareness. The Minnesota, USA study, done in 2023 also demonstrated that targeted educational interventions, rather than SES, significantly improved knowledge.<sup>39</sup>

**Table 14: Descriptive analysis of knowledge score about climate change pre-test and post-test in study population.**

It was observed notable changes in understanding of climate change, as evidenced by the average pre-test score of 13.45 with a standard deviation of  $\pm 1.08$  and a post-test average score of 17.04 with a standard deviation of  $\pm 1.44$ . Furthermore, the median scores increased from 13 to 17, and the range changed from 10-16 to 15-19. This data strongly suggests that the intervention had a profound impact on participants' understanding of the issue. A comparison can be made with other studies that focused on different demographics and had similar findings. Nurses who took the "Climate Change and Health" course in Turkey in 2024 had impressive achievements, signifying how a change in teaching methods can enhance climate change understanding and make literacy difference.<sup>65</sup> Also, in a pre-test-post-test assessment of a massive open online course on climate science, student knowledge, attitudes, and competencies related to climate were found to be at an improved level. Our study's large effect size suggests that the intervention was highly effective in enhancing knowledge, comparable to the substantial improvements seen in these prior studies.

**Table 15: Positive Attitudes towards Climate Change**

Post-intervention, an increase was noted in participants' support for climate change education as part of the curriculum (from 57.81% to 100%) and waste recycling as a mitigation strategy (from 30.94% to 100%). This trend is consistent with the systematic review on climate education, which reported a 20% increase in pro-environmental behaviours following educational interventions.<sup>29</sup> However, a decline in agreement with the statement that "human actions are a cause for climate change" (from 87.81% in the pre-test to 71.88% in post-test) was observed. This shift contrasts with findings from the Mangalore study of 2016, where science students demonstrated greater acceptance of human-caused climate change compared to non-science students.<sup>38</sup> The drop in agreement in our study may indicate residual misconceptions or a nuanced understanding developed post-intervention that led some participants to question simplistic attributions.

**Table 16: Negative Attitudes towards Climate Change**

Post-test responses showed a decline in climate change scepticism, with the percentage of participants agreeing that “climate change is not a real problem” decreasing from 61.56% in the pre-test to 10% post-test. This result mirrors findings from the Minnesota, USA study of 2023 among 218 participants, where an animated educational video significantly improved knowledge and confidence in discussing climate issues.<sup>39</sup> The decrease in agreement with the statement “nature is strong enough to cope with industrial impact” (from 91.25% in pre-test to 40.31% in post-test) further supports the positive impact of targeted climate education, aligning with research that highlights the role of interactive learning in dispelling misconceptions.<sup>31</sup>

**Table 17: Effect size of changes in positive attitudes towards climate change**

In line with earlier studies showing the value of structured educational interventions in improving attitudes toward climate change, our study revealed that several assertions had higher agreement, indicating increased awareness and a change in understanding. Similar findings were found in the research done in Turkey in 2024 assessing a "Climate Change and Health" course among nursing students, which found that after the intervention, knowledge and favourable attitudes regarding global warming had significantly improved. Similar improvements in participants' climate-related attitudes were found in an evaluation of a Massive Open Online Course (MOOC) on climate change science, done in Spain in 2019 among 530 participants, with effect sizes ranging from 0.5 to 0.7, indicating moderate to strong impacts.<sup>66</sup> Furthermore, an average impact size of 0.3 was identified in a meta-analysis of climate change mitigation interventions done in 2016, which corresponds to a 12% increase in pro-environmental behaviours following the educational programs.<sup>67</sup> Our study's higher agreement with some assertions in comparison to previous results points to a similar pattern of attitude changes, highlighting the importance of education in raising climate awareness. Similar to the previously mentioned studies, the present study showed a significant improvement, suggesting that the intervention was helpful in getting participants to think critically about climate-related concerns.

**Table 18: Effect size of changes in negative attitudes towards climate change**

Our study demonstrated a strong effect size in reducing negative attitudes toward climate change, indicating a successful intervention. The significant shifts in statements like "climate change is not a real problem" and the increased disagreement with "Maintaining economic growth is more important than protecting the environment" suggest a heightened awareness of climate issues. These findings align with prior research that examined the impact of educational interventions on climate-related attitudes. A meta-analysis of climate change mitigation interventions done in 2016 found an average effect size of 0.3, reflecting a 12% increase in pro-environmental behaviours post-intervention.<sup>67</sup> This suggests that while educational efforts can reduce negative attitudes, the effect size remains modest in many cases. Furthermore, studies have shown that misinformation about climate change often has a stronger impact on reinforcing negative attitudes than education has in correcting them, indicating that negative beliefs may be more difficult to counteract than positive ones.<sup>68</sup> The strong effect size observed in our study suggests that the intervention was particularly effective at challenging misconceptions and promoting climate awareness, potentially due to the structured nature of the educational approach. These results emphasize the importance of targeted strategies in combating climate scepticism and fostering a more informed and environmentally conscious mindset.

**Table 19: Practices towards Climate Change**

Significant improvements were observed in environmentally friendly behaviours post-test, particularly in reducing non-vegetarian diets, using recyclable materials, and turning off electrical appliances. The observed changes align with findings from the Canadian intervention study done among 200 participants in 2022, which highlighted a 25% increase in sustainable behaviours following an educational program.<sup>28</sup> A systematic review done in 2023 also emphasized that experiential learning, such as workshops and interactive activities, led to a 20% increase in pro-environmental behaviours.<sup>29</sup> However, the decline in certain behaviours, such as reducing plastic use and donating clothes, indicates the need for continuous reinforcement of climate-friendly habits.

**Table 20: Descriptive analysis of reasons for sustainable practices in the study population**

Our research showed that participants' justifications for adopting climate-sensitive behaviours have changed, with pre-test answers mostly falling into three groups: habit, health and environmental protection. Post-test answers, on the other hand, were more varied and took into account extra elements including practicality, cost savings and moral responsibility. This extension of logic is consistent with earlier research examining the incentives behind adopting climate-friendly practices. According to research, sustainable practices are primarily motivated by ethical and environmental considerations, which frequently take precedence over monetary rewards.<sup>69</sup> Furthermore, research shows that behaviour is strongly influenced by one's personal identity and values, particularly when sustainability initiatives are presented as relevant to people's everyday life.<sup>70</sup> Social norms also have a significant influence because people are more likely to adopt eco-friendly practices when they observe others around them doing so.<sup>71</sup> Additionally, according to the 'Theory of Planned Behaviour', people's intentions to form sustainable habits are influenced by their attitudes, subjective standards and perceived behavioural control.<sup>72</sup> Our post-test responses revealed a widening of incentives, which implies that greater awareness resulted in a more thorough comprehension of the various advantages of climate-sensitive behaviour. This bolsters the notion that educational initiatives can successfully broaden people's horizons, promoting not only environmental stewardship, but also realistic and ethical incentives for sustainable living.

**Table 21: Effect size of changes in climate sensitive practices towards climate change**

Several climate-sensitive behaviours, such as investing more in eco-friendly products (Cramer's  $V = 0.701$ ), planting saplings (Cramer's  $V = 0.683$ ), and shutting off lights and electronics when not in use (Cramer's  $V = 0.737$ ), showed substantial correlations with climate change awareness among participants according to our research. According to a metanalysis done in 2023, pro-environmental behaviours increased by 12%, with an uncorrected impact size of  $d = 0.31$ .<sup>73</sup> Nonetheless, our study found only moderate associations for some practices, such as using energy-efficient appliances (Cramer's  $V = 0.218$ ) and cutting back on meat consumption (Cramer's  $V = 0.331$ ). These findings are consistent with the idea that social and financial incentives frequently influence these behaviours more than just climate awareness.<sup>74</sup> Reducing plastic consumption (Cramer's  $V = 0.285$ ) and taking public transportation (Cramer's  $V = 0.023$ ) were found to have weak connections, suggesting that although these activities may promote sustainability, they are not often motivated by awareness of climate change. These findings are consistent with more general behavioural research that indicates that social conventions, cost considerations and convenience frequently influence daily routines more than direct climate concerns.<sup>74</sup> Furthermore, the total absence of a correlation between carpooling and climate awareness (Cramer's  $V = 0$ ) raises the possibility that systemic and infrastructure problems may be more important in influencing these kinds of behaviours. These results support the idea that, although awareness efforts have the potential to significantly increase climate-sensitive behaviour, their effects differ based on the practice and underlying drivers.

**Table 22: Effectiveness of Intervention**

In our study a majority of participants rated the intervention as either effective (40.31%) or very effective (30.94%), indicating strong engagement. This aligns with findings from the video-based education study done in Minnesota, USA in 2023 among 218 participants, where a short-animated intervention led to substantial improvements in knowledge retention and behavioural intentions.<sup>39</sup> The mixed-methods study on youth climate engagement in Bangladesh, Guatemala and Nigeria also found that participatory approaches improved engagement and retention.<sup>44</sup> These findings underscore the role of engaging, visually appealing educational content in climate change education.

Overall, the intervention led to significant improvements in most climate-friendly behaviours of study participants, particularly those that required conscious daily efforts. The results reinforce the effectiveness of structured educational programs in fostering sustainable lifestyle changes for climate change.

## **Discussion of qualitative results -**

### **Key Insights and Takeaways**

1. **Waste management was a primary concern.** Many respondents focused on reducing waste, recycling, and finding alternatives to plastic.
2. **Government policies and incentives are seen as crucial.** People recognized the role of governance in promoting sustainability through laws, subsidies and regulations.
3. **Renewable energy and carbon footprint reduction are key themes.** There was awareness of the impact of carbon emissions and interest in alternative energy sources like biogas and biofuel.
4. **Community involvement and education matter.** Encouraging awareness and sustainable practices at a social level was considered important for long-term environmental improvement.
5. **Sustainable transportation is an emerging focus.** Cycling, reducing driving, and eco-friendly travel habits were mentioned as ways to reduce carbon emissions.

**Innovative alternatives are gaining attention.** From compostable products to sustainable fabrics, respondents were thinking of ways to shift their consumption habits toward environmentally friendly options.

The qualitative study highlights key themes such as sustainability and environmental conservation, policy action, waste management, education, and personal responsibility, all of which align with previous research on students' perceptions of climate change. The qualitative study among 32 Fijian university students done in 2021 found that many participants had a strong awareness of climate issues and saw personal responsibility as essential for sustainable living, similar to how students in our study advocated for lifestyle changes like planting trees, reducing plastic use, and adopting eco-friendly habits.<sup>75</sup> Additionally, the emphasis on policy action and government responsibility in our study mirrors findings from research on medical students' understanding of climate change and health impacts, where students identified gaps in climate-related policies and called for systemic changes in educational curricula and institutional sustainability efforts.<sup>76</sup> Waste management, another major theme, was reflected in

students' responses about recycling, upcycling and community-driven initiatives. This aligns with the binational youth climate concern study, which found that cultural contexts influence sustainable behaviours, with some students emphasizing policy-driven solutions while others focused on grassroots efforts like waste reduction and community initiatives.<sup>77</sup> Furthermore, the role of education and social media in spreading awareness was a key finding in both our study and prior research, highlighting how students use digital platforms to advocate for climate-friendly behaviours. The emergence of community-based actions in our study, such as collective tree planting and peer influence, further supports findings that youth engagement in climate action is heavily influenced by social and cultural factors. Collectively, these insights reinforce the need for integrating climate education into academic curricula, while supporting both institutional policies and grassroots student-led initiatives to foster meaningful climate action.

## **CONCLUSION**

This study aimed to assess the effect of a video-based educational intervention on the knowledge, attitudes and practices of 320 undergraduate college students in Belagavi city towards climate change. The findings demonstrate a significant positive impact of the intervention, highlighting the efficacy of structured educational programmes in fostering climate awareness and behavioural changes among young adults.

The knowledge scores pre- and post-assessment have shown a remarkable increase of the mean knowledge score from 13.45 to 17.04. The calculated effect size of 2.82, using Cohen's *d*, indicates a very large effect, which gives substantial weight to the intervention regarding its role in enhancing climate change knowledge. The specific areas of improvement include a clearer understanding of the causes of climate change, understanding the role of greenhouse gases and differentiating climate from weather. The awareness of climate change issues at the global level, including the perception of India's contribution to climate change, also showed an improvement.

Regarding attitudes, the intervention had considerable shifts in both positive and negative perceptions related to climate change. The number of participants agreeing with climate change education in academic curricula increased to 100%, which is indicative of a raised sense of global importance. The belief that individuals and governments have responsibilities in advocating climate-change issues also completely turned to that of agreement during the post-intervention survey. Furthermore, declines in misconceptions - for instance, the belief that radiations widen the hole in the ozone layer-successfully lent credence to the intervention in the clarification of scientific concepts. The negative attitudes had also

been significantly transformed: for instance, participants who held the notion that climate change is a non-problem dropped swiftly from 61.56% to 10%, thus showing a remarkable reduction in climate change-related scepticism.

Sustainability-aware actions were also marked by the study as significantly different. Participants also reported an increased willingness to show sustainable actions, such as spending on eco-friendly products (9.38% to 79.38%), planting saplings (10% to 78.13%), and waste segregation (10% to 79.69%). Such behavioural changes were justified by strong positive effect sizes, which went in favour of the converting-to-action-expectations brought about by the greater knowledge. A few instances of previous engagement in sustainable actions, such as the use of plastic, showed a slight drop possibly because critical awareness had increased regarding effective plastic reduction strategies.

Qualitative thematic analysis further reinforced the quantitative findings. One of the key themes that emerged from the analysis that corroborated the regression findings focused around sustainability, responsibility of governments, waste management, education and personal responsibility. Taking a proactive approach to climate change mitigation, several students lit the spark of peer awareness-campaigns that reached out to others and called for a reform of policy. The increase in discussions on climate-related issues, among participants post-intervention, underscores the societal ramifications of climate education; thus, such education must extend beyond the provisioning of knowledge and practices at the individual level and penetrate deep to the level of the community.

The perceived effectiveness of the interventions was rated positively by the majority of the participants, such that 40.31% of those considered it 'Effective' and 30.94% of them rated it 'Very Effective.' Thus, these responses underscore the importance of targeted educational approaches in shaping climate-conscious mindsets and behaviours among young adults.

Our study hence concludes that structured educational interventions promote awareness of climate change, favourable attitudes, and pro-environmental behaviours among undergraduate students. The study objective of trying to assess the effectiveness of such an intervention was fulfilled not just in terms of statistical analysis but also with the help of insights from a qualitative analysis. The study stresses the importance of education as an essential instrument in developing climate resilience and building knowledge and motivation in young people, so they can contribute positively to sustainable environmental solutions.

## **RECOMMENDATIONS**

### **1. At Individual/Family Level**

Encouraging households to adopt eco-friendly behaviours such as waste segregation, energy conservation, and reduced plastic use can contribute significantly to local environmental well-being. Encouraging youth participation through family-led activities like tree planting, home composting, and sustainable consumption choices enhances long-term climate responsibility. Pollution-reducing initiatives, such as forming cycling or running clubs, can also be adopted at the family level to promote healthier and more sustainable lifestyles.

### **2. At Institutional and Educators Level**

Institutions should establish sustainability policies—like promoting public transportation and banning single-use plastics—to encourage eco-friendly behaviour. Educators can foster student engagement through extracurricular groups focused on environmental conservation and provide platforms for student-led initiatives. Collaboration with local NGOs and the inclusion of behavioural change strategies within institutional policies can drive long-lasting climate action. Regular assessments, such as green audits mandated by the National Assessment and Accreditation Council (NAAC), are vital for monitoring and improving institutional sustainability efforts. Furthermore, institutions should support the creation of sustainable infrastructure and adopt comprehensive recycling programs. The integration of sustainability practices within existing national frameworks, such as the National Institute Ranking Framework (NIRF), to evaluate institutional progress is a good initiative and incentivizing sustainable development based on performance could also be thought of.

### **3. At Researchers Level**

Researchers can advance climate action by expanding intervention models to diverse educational settings, ensuring adaptability and scalability across regions. Future research should focus on long-term behavioural change and the effectiveness of sustainability interventions post-graduation. Academic institutions should prioritize climate-oriented thesis topics and include sustainability research in their core agendas. Researchers should also explore

innovative pedagogical tools to embed sustainability concepts in educational frameworks while advocating for policy changes that align with their findings to institutionalize sustainable practices at a broader level.

#### **4. At Local, Regional, and National Level**

Local bodies should promote grassroots efforts like district-level competitions and community-led environmental programs. At the regional level, initiatives such as Swachh Survekshan can drive public engagement and policy compliance. Nationally, financial incentives—including subsidies, scholarships, and project grants—can motivate student participation in sustainability programs. Policy frameworks should integrate sustainability criteria within national assessment systems like NIRF to ensure institutions prioritize and measure their climate efforts. Moreover, there should be mandatory implementation of sustainability-focused programs, such as energy-efficient infrastructure, across all educational levels.

#### **5. At Global Level**

Global organizations, including the UN, WHO, UNEP, and IPCC, must enhance the dissemination of climate knowledge to ensure it reaches grassroots levels. These bodies can strengthen their outreach by partnering with educational institutions to implement localized awareness programs. Facilitating resource-sharing between international and local organizations can increase access to climate education. Global entities should provide frameworks for monitoring and evaluating local climate initiatives.

### **STRENGTHS:**

This study employed a pre-test-post-test design, conducted among the same set of participants which allowed for an effective assessment of changes in knowledge, attitudes and practices (KAP) following the intervention, while minimizing variability due to participant differences.

The selection of four colleges in Belagavi city through a random process enhanced the external validity and generalizability of the findings.

A statistically justified sample size of 320 participants, determined using G-Power software, ensured the study has adequate power (95%) to detect meaningful differences.

The intervention was standardized among the participants, comprising a structured PowerPoint presentation, an educational video (GoClimate)<sup>49</sup>, interactive discussions and printed handouts, ensuring consistency in exposure. Also, cross-contamination was minimized by conducting the pre-test on a single day, which prevented information from spreading among groups before the intervention.

A validated questionnaire covering socio-demographics and KAP ensured comprehensive data collection. Additionally, a minimum one-month post-test interval helped to mitigate recall bias while allowing participants time to adopt new behaviours.

Ethical considerations were upheld, with written informed consent obtained and no financial burden placed on participants, as all costs were covered by the investigator.

## **LIMITATIONS:**

Despite its strengths, the study lacked a control group, making it difficult to determine whether observed changes resulted solely from the intervention or any other external factors. The one-month follow-up period did not allow for long-term evaluation of sustained behaviour change, which is essential for assessing the consolidation of new habits.

The reliance on self-reported questionnaires introduced the risk of social desirability bias, where participants may have overstated positive behaviours rather than report their actual actions.

Additionally, a response bias may have arisen, as students with a prior interest in climate change might have been more engaged, while those with little interest might have completed the questionnaire without genuine reflection, affecting the reliability of data.

The study's findings may have limited generalizability, as it is conducted in only four colleges within Belagavi city, potentially restricting applicability to students from different educational, socio-economic, or geographical backgrounds. Furthermore, while self-reported practices are measured, the study did not objectively assess/observe real-world behaviour changes, such as reductions in carbon footprint or increased eco-friendly actions, limiting the depth of practical behavioural evaluation of the study participants.

In consideration of overcoming the limitations of this study, further research would benefit from inclusion of a control group to facilitate cause-and-effect inferences between the intervention and outcome measures, and extension of follow-up period to determine the long-term sustainability of the behaviour changes. A combination of self-rated performance and objective measures, like monitoring actual eco-friendly behaviours, will reduce social desirability bias and yield more accurate responses. The diversity in geographical and socio-economic contexts could improve the generalizability of the study, whereas ensuring diversity among participants and adopting strategies such as anonymous responses may reduce response bias.

## **SUMMARY**

This study aimed to assess the impact of an educational intervention on climate change awareness, attitudes and practices among undergraduate students in Belagavi city. The study was conducted as a facility-based interventional study with a pre-test-post-test design over a 12-month period (April 1, 2023, to March 31, 2024). The sample size was determined using G-Power software, resulting in a final sample of 320 students selected proportionally from four colleges in Belagavi city (two from the North zone and two from the South zone) in Karnataka, India.

The study included first-year undergraduate students from the selected colleges, with exclusion criteria set for students absent during the pre-test. Data collection was done using a predesigned and structured questionnaire covering socio-demographic factors, knowledge, attitudes and practices related to climate change. A pilot study was conducted before finalizing the questionnaire. Ethical clearance was obtained from the institutional ethical committee of the medical college and written informed consent was obtained from all study participants.

The intervention consisted of a 15-minute PowerPoint presentation on climate change, followed by a 16-minute educational video from GoClimate, an interactive discussion, and handouts summarizing key information. Post-intervention data was collected after one month to measure knowledge retention and behaviour change among the same study participants.

The study population had a fairly uniform age distribution, with participants aged 18-23 years and a mean age of  $20.54 \pm 1.75$  years. Females comprised 55.31% of the sample, while 44.69% were male. Most participants were enrolled in Bachelor of Technology (34.3%) and Bachelor of Computer Applications (28.1%) programs. The majority (76.25%) came from urban areas, whereas 23.75% were from rural backgrounds. Regarding socioeconomic status (SES), 31.25% of participants belonged to the highest SES category (Class I), while only 1.25% were in the lowest category (Class V). Awareness of climate change increased from 90.94% (pre-test) to 98.75% (post-test).

Understanding the difference between climate and weather improved significantly, rising from 9.06% to 81.88%. The view of climate change as an international crisis increased slightly from 81.25% to 84.06%. Participants' knowledge of greenhouse gases also showed improvement, increasing from 91.88% to 100% post-test. The mean knowledge score rose from 13.45 in the

pre-test to 17.04 in the post-test, with a large effect size (Cohen's  $d = 2.82$ ), indicating a strong impact of the intervention. There was no statistically significant association found between the knowledge scores and gender, socioeconomic status, place of residence and educational course undertaken.

Agreement that climate change education should be part of every curriculum increased from 57.81% to 100% post-intervention. The perception that India is a major contributor to global climate change rose from 30.94% to 57.81%. Belief that individuals and the government share equal responsibility for tackling climate change increased from 45.63% to 100%. Additionally, agreement with the idea that all renewable energy technologies are expensive dropped from 71.25% to 16.56%, indicating improved perceptions of affordability.

Spending on eco-friendly products increased from 9.38% to 79.38%, while the number of participants planting saplings rose from 10% to 78.13%. Waste segregation in separate bins increased from 10% to 79.69%, and the use of energy-saving appliances grew from 61.56% to 81.56%. Willingness to choose an electric vehicle over petrol or diesel vehicles increased significantly from 0% to 59.69%. Additionally, the frequency of climate change discussions with friends and family rose from 81.88% to 96.88%. Effect size analysis using Cramer's  $V$  indicated strong associations for several sustainable practices, reflecting meaningful behavioural changes post-intervention.

A thematic analysis identified five key themes:

1. **Sustainability and Environmental Conservation** - Participants emphasized adopting eco-friendly habits such as cycling, using bamboo products, and switching to LED bulbs.
2. **Policy Action and Government Responsibility** - Students advocated for stricter climate policies, subsidies for sustainable products, and mandatory solar panels in colleges.
3. **Waste Management and Recycling** - Many students highlighted the importance of proper waste disposal and shared personal efforts like upcycling clothes.
4. **Education and Awareness** - Participants stressed the need for climate change education at all levels and the role of social media in spreading awareness.

5. **Personal Responsibility and Community Efforts** - Some students initiated local green projects, such as planting trees and using eco-friendly household products.

The study underscores the effectiveness of targeted educational interventions in improving climate change knowledge, attitudes, and behaviours. The findings emphasize the necessity of **continuous education, policy enhancements, and community involvement** to sustain positive environmental practices among youth. Moving forward, a **multi-stakeholder approach involving educational institutions, policymakers, and individuals** will be crucial in fostering long-term climate resilience and sustainability.

The study's methodological quality was evaluated using the 'Mixed Methods Appraisal Tool' (MMAT) to critically assess its strengths and limitations. The research question was clearly articulated, focusing on the impact of an educational intervention on climate change awareness, attitudes, and practices among undergraduate students in Belagavi city. The study employed an appropriate pre-test-post-test design over a 12-month period, allowing for a comprehensive assessment of both immediate and sustained changes. The sample size of 320 participants was determined using G-Power software, ensuring statistical adequacy, and the proportional sampling from four colleges improved the generalizability of the findings within the region.

Data collection was carried out utilizing a predesigned, structured questionnaire that had undergone validity and reliability testing prior to adoption. Ethical considerations were rigorously followed, including obtaining ethical clearance from the institutional ethical committee and written informed consent from all participants. The intervention was systematically designed, combining a PowerPoint presentation, an educational video, interactive discussions and handouts, which enhanced the depth and consistency of the educational delivery. Post-intervention data were collected after one month, allowing for the evaluation of knowledge retention and behaviour change over time.

Quantitative analysis revealed significant improvements in climate change knowledge and sustainable practices, with effect sizes (e.g., Cohen's  $d = 2.82$  for knowledge score changes) indicating a strong impact. However, the study acknowledged some limitations. There was no statistically significant association between knowledge scores and variables such as gender, socioeconomic status, place of residence, and educational course, which suggests that further exploration of contextual factors may be needed. Additionally, while the pre-test-post-test

design captures temporal changes, the absence of a control group limits the ability to attribute changes solely to the intervention.

Thematic analysis of qualitative responses was conducted rigorously, identifying five key themes related to sustainability, policy action, waste management, education, and personal responsibility. Combining quantitative and qualitative results was achieved through complementary analysis, strengthening the credibility of the results. Nevertheless, future research could benefit from longitudinal designs to examine long-term behaviour retention and the inclusion of diverse educational contexts to enhance external validity.

Overall, the study demonstrated methodological rigour across key MMAT domains, including clear research questions, appropriate design, robust data collection methods and thorough integration of mixed-methods findings. While the study effectively captured meaningful behavioural changes, addressing the absence of a control group and expanding the contextual scope would further strengthen the validity and generalizability of the findings.

**BIBLIOGRAPHY**

1. An Introduction to the Word Climate [Internet]. Climate in Arts and History. [cited 2025 Jan 5]. Available from: <https://www.science.smith.edu/climatelit/intro-to-the-word-climate/>
2. Climate [Internet]. World Meteorological Organization. 2022 [cited 2025 Jan 5]. Available from: <https://wmo.int/topics/climate>
3. Lindgren E, Ebi KL, Johannesson M, European Centre for Disease Prevention and Control, editors. Climate change and communicable diseases in the EU Member States: handbook for national vulnerability, impact and adaptation assessments. Luxembourg: Publications Office; 2010. 1 p.
4. Climatic change: are we on the brink of a pronounced global warming? - PubMed [Internet]. [cited 2025 Jan 5]. Available from: <https://pubmed.ncbi.nlm.nih.gov/17781884/>
5. What Is the Sun's Role in Climate Change? - NASA Science [Internet]. [cited 2025 Jan 5]. Available from: <https://science.nasa.gov/earth/climate-change/what-is-the-suns-role-in-climate-change/>
6. [cited 2025 Jan 5]. Available from: <https://www.usgs.gov/programs/VHP/volcanoes-can-affect-climate>
7. Milankovitch (Orbital) Cycles and Their Role in Earth's Climate - NASA Science [Internet]. [cited 2025 Jan 5]. Available from: <https://science.nasa.gov/science-research/earth-science/milankovitch-orbital-cycles-and-their-role-in-earths-climate/>
8. Nations U. Climate Change [Internet]. United Nations. United Nations; [cited 2025 Jan 5]. Available from: <https://www.un.org/en/global-issues/climate-change>
9. United Nations Framework Convention on Climate Change [Internet]. [cited 2025 Jan 5]. Available from: <https://unfccc.int/resource/ccsites/zimbab/conven/text/art01.htm>
10. What is the greenhouse effect? - NASA Science [Internet]. [cited 2025 Jan 5]. Available from: <https://science.nasa.gov/climate-change/faq/what-is-the-greenhouse-effect/>
11. US EPA O. Understanding Global Warming Potentials [Internet]. 2016 [cited 2025 Jan 5]. Available from: <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>
12. Intergovernmental Panel On Climate Change (Ippc). Climate Change 2021 – The Physical Science Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Internet]. 1st ed. Cambridge University Press; 2023 [cited 2025 Jan 5]. Available from: <https://www.cambridge.org/core/product/identifier/9781009157896/type/book>

13. Glossary:Fossil fuel - Statistics Explained [Internet]. [cited 2025 Jan 5]. Available from: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Fossil\\_fuel](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Fossil_fuel)
14. Stein T. Nitrous oxide emissions grew 40 percent from 1980 to 2020, accelerating climate change [Internet]. NOAA Research. 2024 [cited 2025 Jan 5]. Available from: <https://research.noaa.gov/nitrous-oxide-emissions-grew-40-percent-from-1980-to-2020-accelerating-climate-change/>
15. Kondraju TT, Rajan KS. Excessive fertilizer usage drives agriculture growth but depletes water quality. *Isprs Ann Photogramm Remote Sens Spat Inf Sci*. 2019 Mar 1;IV-3-W1:17–23.
16. Evidence - NASA Science [Internet]. [cited 2025 Jan 5]. Available from: <https://science.nasa.gov/climate-change/evidence/>
17. Kotz M, Levermann A, Wenz L. The economic commitment of climate change. *Nature*. 2024 Apr;628(8008):551–7.
18. Health-based strategies for overcoming barriers to climate change adaptation and mitigation. *J Allergy Clin Immunol*. 2023 Nov 1;152(5):1053–9.
19. What are the Costs of Climate Change Impacts on Indian Economy? [Internet]. [cited 2025 Jan 5]. Available from: <https://www.ceew.in/publications/costs-climate-change-impacts-india>
20. European Commission. Joint Research Centre., IEA. GHG emissions of all world countries. [Internet]. LU: Publications Office; 2024 [cited 2025 Jan 5]. Available from: <https://data.europa.eu/doi/10.2760/4002897>
21. Net zero emissions target [Internet]. [cited 2025 Jan 5]. Available from: <https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=1945472>
22. Nations U. Voices of Change [Internet]. United Nations. United Nations; [cited 2025 Jan 5]. Available from: <https://www.un.org/en/climatechange/voices-of-change>
23. India [Internet]. [cited 2025 Jan 5]. Available from: <https://climateactiontracker.org/countries/india/>
24. Climate change education for sustainable development: the UNESCO climate change initiative - UNESCO Digital Library [Internet]. [cited 2025 Jan 5]. Available from: <https://unesdoc.unesco.org/ark:/48223/pf0000190101>
25. Climate without Borders [Internet]. Best Climate Solutions. [cited 2025 Jan 5]. Available from: <https://www.bestclimatesolutions.eu/solution/climate-without-borders/>
26. 2021 WHO Health and Climate Change Global Survey Report. 1st ed. Geneva: World Health Organization; 2021. 1 p.

27. Ofori BY, Ameade EPK, Ohemeng F, Musah Y, Quartey JK, Owusu EH. Climate change knowledge, attitude and perception of undergraduate students in Ghana. *PLOS Clim.* 2023 Jun 7;2(6):e0000215.
28. Null DC, Hurst KF, Duram LA. Beyond the classroom: Influence of a sustainability intervention on university students' environmental knowledge and behaviors. *J Environ Stud Sci.* 2024 Jun 1;14(2):224–35.
29. Worldwide effects of climate change education on the cognitions, attitudes, and behaviors of schoolchildren and their entourage. A systematic review [Internet]. [cited 2025 Jan 5]. Available from: <https://www.afd.fr/en/ressources/worldwide-effects-climate-change-education-cognitions-attitudes-and-behaviors-schoolchildren-and-their-entourage-systematic-review>
30. Barrón NG, Gruber S, Huffman G. Student Engagement and Environmental Awareness: Gen Z and Ecocomposition. *Environ Humanit.* 2022 Mar 1;14(1):219–32.
31. Puttick GM, Drayton B, Silva C. Innovations in Undergraduate Teaching and Learning of Earth and Environmental Science, with a Focus on Climate Change. *J Coll Sci Teach.* 2022;51(4):65–78.
32. Gold AU, Oonk DJ, Smith L, Boykoff MT, Osnes B, Sullivan SB. Lens on Climate Change: Making Climate Meaningful Through Student-Produced Videos. *J Geogr.* 2015 Nov 2;114(6):235–46.
33. Knowledge, attitudes and practices study on climate change and the environment (teachers) | UNICEF North Macedonia [Internet]. 2022 [cited 2025 Jan 5]. Available from: <https://www.unicef.org/northmacedonia/reports/knowledge-attitudes-and-practices-study-climate-change-and-environment-teachers>
34. Grenada Climate Change KAP [Internet]. UNDP. [cited 2025 Jan 5]. Available from: <https://www.undp.org/barbados/publications/grenada-climate-change-kap>
35. Kumar A, Jacob A, Paul N, S RP. A study on KAP regarding environment and global warming in senior secondary school students in Kochi, Kerala. *Int J Community Med Public Health.* 2019;6(1):168–72.
36. Reddy GP, Rajamouli J, Arora KD, Jothula KY, Amaravadi S, Boda A. Knowledge, perceptions and practices of medical students towards climate change and global warming: A cross sectional study. *J Fam Med Prim Care.* 2022 Jun;11(6):2557.
37. Karami S, Shobeiri SM, Jafari H. Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. *Int J Clim Change Strateg Manag.* 2017 May 15;9(03):402–15.
38. <https://www.indianjournals.com/ijor.aspx?target=ijor:ijphrd&volume=10&issue=1&article=049>. [cited 2025 Jan 24]; Available from: <https://www.indianjournals.com/ijor.aspx?target=ijor:ijphrd&volume=10&issue=1&article=049>

39. Doheny BM, Inglis JJ, Boll KA, Lunos S, Surapaneni VL. Short animated video increases knowledge and perceived comfort in clinical counseling on inequitable health impacts of air pollution among interprofessional health learners and clinicians. *BMC Med Educ*. 2023 Nov 12;23(1):858.
40. Hejl CDK, Qvortrup A. Inquiring sustainability through dialogic Video Clubs in upper secondary schools. *Environ Educ Res*. 2024 Sep 1;30(9):1552–70.
41. Cordero EC, Centeno D, Todd AM. The role of climate change education on individual lifetime carbon emissions. *PLOS ONE*. 2020 Feb 4;15(2):e0206266.
42. Shrikhande S, Merten S, Cambaco O, Lee TT, Lakshmanasamy R, Rösli M, et al. Barriers to climate change and health research in India: a qualitative study. *BMJ Open*. 2023 Oct 1;13(10):e073381.
43. Rocque RJ, Beaudoin C, Ndjaboue R, Cameron L, Poirier-Bergeron L, Poulin-Rheault RA, et al. Health effects of climate change: an overview of systematic reviews. *BMJ Open*. 2021 Jun 9;11(6):e046333.
44. Pinchoff J, Etetim EO, Babatunde D, Blomstrom E, Ainul S, Akomolafe TO, et al. How climate change is shaping young people’s health: a participatory, youth co-led study from Bangladesh, Guatemala and Nigeria. *BMJ Glob Health*. 2025 Jan;10(1):e016788.
45. Ryan EC, Dubrow R, Sherman JD. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. *BMC Med Educ*. 2020 Jun 23;20:200.
46. Nisa CF, Bélanger JJ, Schumpe BM, Faller DG. Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. *Nat Commun*. 2019 Oct 4;10(1):4545.
47. Updated B. G. Prasad Scale for Socioeconomic Status Classification for the Year 2024 | *Indian Journal of Pediatrics* [Internet]. [cited 2025 Jan 19]. Available from: <https://link.springer.com/article/10.1007/s12098-024-05131-z>
48. Official website of Labour Bureau, Ministry of Labour and Employment, Government of India [Internet]. [cited 2025 Feb 27]. Available from: <https://www.labourbureau.gov.in/>
49. Friendly Guide to Climate Change - and what you can do to help #everytoncounts [Internet]. 2017 [cited 2025 Jan 19]. Available from: [https://www.youtube.com/watch?v=3CM\\_KkDuzGQ](https://www.youtube.com/watch?v=3CM_KkDuzGQ)
50. NVivo: Leading Qualitative Data Analysis Software [Internet]. Lumivero. [cited 2025 Feb 1]. Available from: <https://lumivero.com/products/nvivo/>
51. Mathews D, Franzen-Castle L, Colby S, Kattelman K, Olfert M, White A. Use of Word Clouds as a Novel Approach for Analysis and Presentation of Qualitative Data for Program Evaluation. *J Nutr Educ Behav*. 2015 Jul 1;47(4):S26.

52. Qualitative Studies Checklist - CASP [Internet]. CASP - Critical Appraisal Skills Programme. [cited 2025 Feb 2]. Available from: <https://casp-uk.net/casp-tools-checklists/qualitative-studies-checklist/>
53. SPSS Statistics 22.0 Available for Download [Internet]. 2020 [cited 2025 Feb 10]. Available from: <https://www.ibm.com/support/pages/spss-statistics-220-available-download>
54. Europeans over 30 understand climate change better than younger generations, EIB survey finds [Internet]. European Investment Bank. [cited 2025 Feb 15]. Available from: <https://www.eib.org/en/press/all/2024-269-europeans-over-30-understand-climate-change-better-than-younger-generations-eib-survey-finds>
55. Salem MR, Hegazy N, Thabet Mohammed AA, Mahrous Hassan E, Saad Abdou MM, Zein MM. Climate change-related knowledge and attitudes among a sample of the general population in Egypt. *Front Public Health*. 2022 Nov 3;10:1047301.
56. Carrillo-Nieves D, Clarke-Crespo E, Cervantes-Avilés P, Cuevas-Cancino M, Vanoye-García AY. Designing learning experiences on climate change for undergraduate students of different majors. *Front Educ* [Internet]. 2024 Feb 8 [cited 2025 Feb 16];9. Available from: <https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2024.1284593/full>
57. Gammon K. A US university has a new requirement to graduate: take a climate change course. *The Guardian* [Internet]. 2024 Oct 15 [cited 2025 Feb 16]; Available from: <https://www.theguardian.com/environment/2024/oct/15/california-university-ucsd-climate-change-course-requirement>
58. Ellis M. Every SFSU student must soon take climate justice course to graduate [Internet]. *San Francisco Chronicle*. 2025 [cited 2025 Feb 16]. Available from: <https://www.sfchronicle.com/climate/article/sf-state-environmental-justice-19989133.php>
59. Welcome to UGC, New Delhi, India [Internet]. [cited 2025 Feb 27]. Available from: [https://www.ugc.gov.in/Bureaus/bureaus\\_details?N1fYVIou%2BYanDS3L0ux5o2WXQqHCEqcdtRAiBRnkiN8FE8YLC4P5%2B05NwZd2LVQc](https://www.ugc.gov.in/Bureaus/bureaus_details?N1fYVIou%2BYanDS3L0ux5o2WXQqHCEqcdtRAiBRnkiN8FE8YLC4P5%2B05NwZd2LVQc)
60. Nielsen KS, Nicholas KA, Creutzig F, Dietz T, Stern PC. The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. *Nat Energy*. 2021 Nov;6(11):1011–6.
61. Esperón-Rodríguez M, Bonifacio-Bautista M, Barradas VL. Socio-economic vulnerability to climate change in the central mountainous region of eastern Mexico. *Ambio*. 2016 Mar;45(2):146–60.
62. Social Dimensions of Climate Change [Internet]. World Bank. [cited 2025 Feb 16]. Available from: <https://www.worldbank.org/en/topic/social-dimensions-of-climate-change>

63. Droughts, Dalits & Adivasis: a study on the impact of droughts catalysed by climate change on the Dalits and the Adivasis of Marathwada region of Maharashtra | PreventionWeb [Internet]. 2022 [cited 2025 Feb 16]. Available from: <https://www.preventionweb.net/publication/droughts-dalits-adivasis-study-impact-droughts-catalysed-climate-change-dalits-and>
64. Caste, unemployment and loss of property raise likelihood of migration in areas of India hit by climate change [Internet]. [cited 2025 Feb 16]. Available from: <https://www.iied.org/caste-unemployment-loss-property-raise-likelihood-migration-areas-india-hit-climate-change>
65. Çolak M, Dogan R, Dogan S. Effect of Climate Change and Health Course on Global Warming Knowledge and Attitudes, Environmental Literacy, and Eco-Anxiety Level of Nursing Students: A Quasi-Experimental Study. *Public Health Nurs* [Internet]. [cited 2025 Feb 16];n/a(n/a). Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/phn.13536>
66. Comparative analysis of pretest and posttest in Knowledge in SR. [Internet]. ResearchGate. [cited 2025 Feb 16]. Available from: [https://www.researchgate.net/figure/Comparative-analysis-of-pretest-and-posttest-in-Knowledge-in-SR\\_tbl2\\_337172154](https://www.researchgate.net/figure/Comparative-analysis-of-pretest-and-posttest-in-Knowledge-in-SR_tbl2_337172154)
67. Kreslake JM, Price KM, Sarfaty M. Developing effective communication materials on the health effects of climate change for vulnerable groups: a mixed methods study. *BMC Public Health*. 2016 Sep 7;16(1):946.
68. Rode JB, Dent AL, Benedict CN, Brosnahan DB, Martinez RL, Ditto PH. Influencing climate change attitudes in the United States: A systematic review and meta-analysis. *J Environ Psychol*. 2021 Aug;76:101623.
69. Fløttum K, Gjerstad Ø, Skiple JK. Climate change and lifestyle: people's expressed motivations to adopt or not adopt a climate-friendly way of life. *ASp Rev GERAS*. 2021 Mar 9;(79):75–94.
70. Motivating climate-friendly behaviour - University of Victoria [Internet]. UVic.ca. 2016 [cited 2025 Feb 16]. Available from: <https://www.uvic.ca/news/topics/2016+climate-psychology-robert-gifford-pics+media-tip>
71. Encourage Climate-Friendly Behaviors as a Social Influencer [Internet]. Rare. [cited 2025 Feb 16]. Available from: <https://rare.org/blog/encourage-climate-friendly-behaviors-as-a-social-influencer/>
72. The theory of planned behavior: Frequently asked questions. [cited 2025 Feb 16]; Available from: [https://onlinelibrary.wiley.com/doi/10.1002/hbe2.195?utm\\_source=chatgpt.com](https://onlinelibrary.wiley.com/doi/10.1002/hbe2.195?utm_source=chatgpt.com)
73. Bergquist M, Thiel M, Goldberg MH, van der Linden S. Field interventions for climate change mitigation behaviors: A second-order meta-analysis. *Proc Natl Acad Sci*. 2023 Mar 28;120(13):e2214851120.

74. Effective behavioral interventions to mitigate climate change [Internet]. Yale Program on Climate Change Communication. [cited 2025 Feb 16]. Available from: <https://climatecommunication.yale.edu/publications/effective-behavioral-interventions-to-mitigate-climate-change/>
75. Prasad RR, Mkumbachi RL. University students' perceptions of climate change: the case study of the University of the South Pacific-Fiji Islands. *Int J Clim Change Strateg Manag*. 2021 Sep 3;13(4/5):416–34.
76. Heydari A, Partovi P, Zarezadeh Y, Yari A. Exploring medical students' perceptions and understanding of the health impacts of climate change: a qualitative content analysis. *BMC Med Educ*. 2023 Oct 18;23(1):774.
77. Thomas I, Martin A, Wicker A, Benoit L. Understanding youths' concerns about climate change: a binational qualitative study of ecological burden and resilience. *Child Adolesc Psychiatry Ment Health*. 2022 Dec 31;16(1):110.

**ANNEXURE – I INFORMED CONSENT FORM**

“ASSESSMENT OF VIDEO BASED EDUCATIONAL PROGRAM ON KNOWLEDGE,  
ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG  
UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI”

**Introduction:** Climate change is a worldwide phenomenon which affects us in many ways. As a part of raising awareness to this global crisis, you are being invited to participate in this study to find out how an educational video affects the knowledge attitude and practices of students towards climate change.

Climatic change has a widespread impact on the ecosystem. Due to these changes, we can see rise in global temperatures, extinction of a number of species of plants and animals and an unnatural increase in natural disasters. So, this study is being done to spread the awareness to this issue and help people make better decisions on an individual level to help slow down this process that may threaten human life as we know it.

Participation in this study is completely voluntary.

**Explanation of procedure:** In this study, you will have to answer a few prepared questions about your Socio-demographic details, basic knowledge about climate change and your attitudes and practices towards it. After this you will be shown an educational video on climate change and you will then be assessed on your knowledge again using the same questionnaire.

**Withdrawal from participation in the study:** Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled.

In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

**Possible benefits from participating in the study:** Your participation ensures more people are aware of climate change and will work towards reducing its effects. As the future members of society who are looked upon to incorporate their beliefs into practices, you will not only be able to make a change yourself but also educate others into helping us achieve our goals. The data gathered will help population at large.

**Possible risks from participating in the study:** There are no risks involved in participating in this study.

**Privacy and confidentiality:** The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

**Financial incentives:** You will not receive any payment for participating in this study.

**Cost of investigations** done during the course of study will be paid by the **principal investigator**.

**Authorization for publication of aggregated data:** Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your personal identity will never be revealed.

**Questions:** In case of any questions with regard to this study, you are free to contact “” If you have any question or complaints with regard to your right as study participant you may contact **Dr. Harsha Hegde**, Chairperson, Institutional Ethical Committee for Human Subjects’ Research of JNMC, Belagavi 0831-2473777 Extension 4052.

**Legal rights:** By signing this consent form, we are not waiving off any of your legal rights

**CONSENT STATEMENT**

“I am making a voluntary decision to participate in the study **“ASSESSMENT OF VIDEO BASED EDUCATIONAL PROGRAM ON KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS CLIMATE CHANGE AMONG UNDERGRADUATE COLLEGE STUDENTS OF BELAGAVI”**. My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.”

Name of the participant: \_\_\_\_\_

Signature or left thumb impression of the participant: \_\_\_\_\_

Name of the witness: \_\_\_\_\_

Signature of the witness: \_\_\_\_\_

Name of the investigator: \_\_\_\_\_

Signature of the investigator: \_\_\_\_\_

Date: \_\_\_\_\_

Place: \_\_\_\_\_

**ANNEXURE - 2**  
**QUESTIONNAIRE**

KAHER



J. N. MEDICAL COLLEGE, BELAGAVI  
DEPARTMENT OF COMMUNITY MEDICINE  
**ANNEXURE – II RESEARCH QUESTIONNAIRE**



**TITLE OF RESEARCH STUDY - “ASSESSMENT OF VIDEO BASED  
EDUCATIONAL PROGRAM ON KNOWLEDGE, ATTITUDES AND PRACTICES  
TOWARDS CLIMATE CHANGE AMONG UNDERGRADUATE COLLEGE  
STUDENTS OF BELAGAVI”**

(Note: The personal data provided by you will be kept confidential. Only aggregated results will be presented/published without revealing your personal identity).

	<b>PRETEST</b>	<b>POST TEST</b>
<b>DATE:</b>		

Sl.NO. \_\_\_\_\_

MOBILE No. \_\_\_\_\_

**I. SOCIODEMOGRAPHIC DETAILS:**

1.1. Name: Mr. / Ms. \_\_\_\_\_

1.2. Age: \_\_\_\_\_ years (as on last birthday)

1.3. Sex: Male / Female

1.4. Area of residence: Urban / Rural

1.5. Degree/Course: \_\_\_\_\_

1.6. Total income of family per month: Rs. \_\_\_\_\_

1.7. Total number of family members: \_\_\_\_\_ Adults: \_\_\_\_\_ Children: \_\_\_\_\_

1.8. Category: GENERAL / SC / ST / OBC / Others

**II. KNOWLEDGE ABOUT CLIMATE CHANGE**

2.1 Have you heard about 'climate change'?

- Yes       No

2.2 Do you think 'climate' and 'weather' are the same?

- Yes       No

2.3 Do you think 'climate change' is a global emergency?

- Yes       No       Don't know/Not Sure

2.4 What do you think 'climate change' is?

- Increase or decrease in temperature  
 Change in rainfall patterns  
 Increase in the frequency of floods/cyclones or natural disasters  
 I don't know / I am not sure

2.5 What do you think is the cause/reason for 'climate change'?

- Deforestation  
 Increase in carbon emissions  
 Industrial effluents  
 Increase in population  
 Urbanization  
 Not sure

2.6 Do you understand the term "greenhouse gases"?

- Yes       No

2.7 What are "greenhouse gases"?

- CO<sub>2</sub>       CH<sub>4</sub>       N<sub>2</sub>O       H<sub>2</sub>O       All of the above

2.8 Burning of fossil fuels results in

- Increased oxygen level  
 Increased ethane level  
 Increased greenhouse gases  
 Decreased greenhouse gases

2.9 Which of the following do you agree with about the ‘greenhouse effect’?

- Life on earth is possible due to greenhouse effect
- Greenhouse effect is a natural process that maintains the earth’s natural temperature
- More greenhouse gases results in more temperature of the earth’s atmosphere
- Increased emission of greenhouse gases is a natural process

2.10 Which of these are a major contributor to ‘carbon emissions’? (Tick all that applies)

- Transportation
- Cutting down forests
- Manufacturing goods
- Generating power
- Producing food
- Industry emissions

2.11 Which are your sources of information regarding ‘climate change’?

- Family and friends                      YES / NO
- TV    YES / NO
- Social Media                                      YES / NO
- Magazines                                        YES / NO
- Newspapers                                      YES / NO

2.12 “ The temperature of the Earth did not increase since 1900.”

- Yes                       No                       Don’t know

### III. ATTITUDE TOWARDS CLIMATE CHANGE

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
3.1	“Human actions are a cause for climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.2	“India is a major contributor to global climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.3	“Climate change is affecting Karnataka state.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.4	“We are too small to do anything about climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.5	“I would only do my bit to reduce climate change if everyone else did as well”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.6	“People need more information about climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.7	“Climate change education be part of every study curriculum”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.8	“Radiations increase the hole of the ozone layer of earth.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.9	“Climate change has a harmful effect on water supply.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.10	“Waste recycling practices help decrease impact of climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.11	“Global warming is both a current and future generation problem.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.12	“Individuals and the government are both equally responsible to tackle climate change.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.13	“Renewable energy sources the solution for global warming”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.14	“All equipment/technology/vehicles with renewable sources of energy are expensive”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.15	“Carbon emission taxes by the government would be a good idea”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.16	“Maintaining economic growth is more important than protecting the environment”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.17	“Nature is strong enough to cope with the impact of modern industrial nations”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.18	“People adapt enough nature-based solutions or alternatives to combat climate change”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.19	“Garbage disposal is not done well by the authorities of my house locality.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.20	“I do not believe climate change is a real problem.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.21	“I would get an electric vehicle over a diesel/petrol vehicle if given the choice.”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### IV. PRACTICES TOWARDS CLIMATE CHANGE

Which of the following do you practice in your own life?

		Yes	No
4.1	I spend more on environment friendly products like recyclable bags, CFLs, bamboo utensils etc.	<input type="radio"/>	<input type="radio"/>
4.2	I consciously reduce the use of plastics.	<input type="radio"/>	<input type="radio"/>
4.3	I recycle and reuse whenever possible.	<input type="radio"/>	<input type="radio"/>
4.4	I planted a sapling in the last 6 months.	<input type="radio"/>	<input type="radio"/>
4.5	I use a solar water heater/ cooker.	<input type="radio"/>	<input type="radio"/>
4.6	I car pool (share) travel with friends.	<input type="radio"/>	<input type="radio"/>
4.7	I have reduced consumption of <b>OR</b> quit <b>OR</b> do not follow a non-vegetarian diet.	<input type="radio"/>	<input type="radio"/>
4.8	I use public transportation to save fuel.	<input type="radio"/>	<input type="radio"/>
4.9	I use energy saving appliances.	<input type="radio"/>	<input type="radio"/>
4.10	I turn off lights/devices when not in use.	<input type="radio"/>	<input type="radio"/>
4.11	I have separate bins for recyclable waste.	<input type="radio"/>	<input type="radio"/>
4.12	I go for prints when you already have softcopies.	<input type="radio"/>	<input type="radio"/>
4.13	I keep appliances <b>OR</b> phones for charging overnight.	<input type="radio"/>	<input type="radio"/>
4.14	Climate change is a common topic of conversation among my friends and family.	<input type="radio"/>	<input type="radio"/>
4.15	I donated my clothes in the past year.	<input type="radio"/>	<input type="radio"/>

The reason I do/ do not do the above practices in my life is due to (tick as many as you feel apply)

- Convenience
- To save money
- To protect the environment
- For my health
- Habit
- Moral obligation
- Other reason - .....

Can you think of any other eco-friendly activities you have engaged yourself with in the past year?

Do you have any suggestions on any innovative practices or attitudes that can be adopted for the betterment of the environment?

How effective did you think the educational video on climate change was?

Not Effective	Could be better	Neutral	Somewhat effective	Very Effective
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

-THANK YOU-

**ANNEXURE – III**

**KEY TO MASTER CHART**

**SOCIODEMOGRAPHIC DETAILS:**

- 1.2. Age: \_\_\_\_\_ years
- 1.3. Sex: 1. Male 2. Female
- 1.4. Area of residence: 1. Urban 2. Rural
- 1.5. Degree/Course: 1- LLB 2- C.S 3- C.E 4- B.Com
- 1.6. Total income of family per month: In Rs.
- 1.7. Total number of family members: In numbers
- 1.8. Category: 1- General 2- OBC 3-SC/ST 4- Others

**KNOWLEDGE ABOUT CLIMATE CHANGE**

- 2.12 Have you heard about ‘climate change’?
1. Yes 2. No
- 2.13 Do you think ‘climate’ and ‘weather’ are the same?
1. Yes 2. No
- 2.14 Do you think ‘climate change’ is a global emergency?
1. Yes 2. No 3. Don’t know/Not Sure
- 2.15 What do you think ‘climate change’ is?
1. Increase or decrease in temperature
2. Change in rainfall patterns
3. Increase in the frequency of floods/cyclones or natural disasters
4. I don’t know / I am not sure
- 2.16 What do you think is the cause/reason for ‘climate change’?
1. Deforestation
2. Increase in carbon emissions

3. Industrial effluents
  4. Increase in population
  5. Urbanization
  6. Not sure
- 2.17 Do you understand the term “greenhouse gases”?
1. Yes
  2. No
- 2.18 What are “greenhouse gases”?
1. CO<sub>2</sub>
  2. CH<sub>4</sub>
  3. N<sub>2</sub>O
  4. H<sub>2</sub>O
  5. All of the above
- 2.19 Burning of fossil fuels results in
1. Increased oxygen level
  2. Increased ethane level
  3. Increased greenhouse gases
  4. Decreased greenhouse gases
- 2.20 Which of the following do you agree with about the ‘greenhouse effect’?
1. Life on earth is possible due to greenhouse effect
  2. Greenhouse effect is a natural process that maintains the earth’s natural temperature
  3. More greenhouse gases results in more temperature of the earth’s atmosphere
  4. Increased emission of greenhouse gases is a natural process
- 2.21 Which of these are a major contributor to ‘carbon emissions’? (Tick all that applies)
1. Transportation
  2. Cutting down forests
  3. Manufacturing goods
  4. Generating power
  5. Producing food
  6. Industry emissions
- 2.22 Which are your sources of information regarding ‘climate change’?
1. Family and friends
-

2. TV
3. Social Media
4. Magazines
5. Newspapers

2.12 “ The temperature of the Earth did not increase since 1900.”

1. Yes
2. No
3. Don't know

## ATTITUDE TOWARDS CLIMATE CHANGE

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
3.1	“Human actions are a cause for climate change.”	1	2	3	4	5
3.2	“India is a major contributor to global climate change.”	1	2	3	4	5
3.3	“Climate change is affecting Karnataka state.”	1	2	3	4	5
3.4	“We are too small to do anything about climate change.”	1	2	3	4	5
3.5	“I would only do my bit to reduce climate change if everyone else did as well”	1	2	3	4	5
3.6	“People need more information about climate change.”	1	2	3	4	5
3.7	“Climate change education be part of every study curriculum”	1	2	3	4	5
3.8	“Radiations increase the hole of the ozone layer of earth.”	1	2	3	4	5
3.9	“Climate change has a harmful effect on water supply.”	1	2	3	4	5
3.10	“Waste recycling practices help decrease impact of climate change.”	1	2	3	4	5
3.11	“Global warming is both a current and future generation problem.”	1	2	3	4	5
3.12	“Individuals and the government are both equally responsible to tackle climate change.”	1	2	3	4	5
3.13	“Renewable energy sources the solution for global warming”	1	2	3	4	5
3.14	“All equipment/technology/vehicles with renewable sources of energy are expensive”	1	2	3	4	5
3.15	“Carbon emission taxes by the government would be a good idea”	1	2	3	4	5
3.16	“Maintaining economic growth is more important than protecting the environment”	1	2	3	4	5
3.17	“Nature is strong enough to cope with the impact of modern industrial nations”	1	2	3	4	5
3.18	“People adapt enough nature-based solutions or alternatives to combat climate change”	1	2	3	4	5
3.19	“Garbage disposal is not done well by the authorities of my house locality.”	1	2	3	4	5
3.20	“I do not believe climate change is a real problem.”	1	2	3	4	5
3.21	“I would get an electric vehicle over a diesel/petrol vehicle if given the choice.”	1	2	3	4	5

## PRACTICES TOWARDS CLIMATE CHANGE

Which of the following do you practice in your own life?

		Yes	No
4.1	I spend more on environment friendly products like recyclable bags, CFLs, bamboo utensils etc.	1	2
4.2	I consciously reduce the use of plastics.	1	2
4.3	I recycle and reuse whenever possible.	1	2
4.4	I planted a sapling in the last 6 months.	1	2
4.5	I use a solar water heater/ cooker.	1	2
4.6	I car pool (share) travel with friends.	1	2
4.7	I have reduced consumption of <b>OR</b> quit <b>OR</b> do not follow a non-vegetarian diet.	1	2
4.8	I use public transportation to save fuel.	1	2
4.9	I use energy saving appliances.	1	2
4.10	I turn off lights/devices when not in use.	1	2
4.11	I have separate bins for recyclable waste.	1	2
4.12	I go for prints when you already have softcopies.	1	2
4.13	I keep appliances <b>OR</b> phones for charging overnight.	1	2
4.14	Climate change is a common topic of conversation among my friends and family.	1	2
4.15	I donated my clothes in the past year.	1	2

The reason I do/ do not do the above practices in my life is due to (tick as many as you feel apply)

1. Convenience
2. To save money
3. To protect the environment
4. For my health
5. Habit
6. Moral obligation

Open-ended questions for qualitative analysis -

1. Can you think of any other eco-friendly activities you have engaged yourself with in the past year?
2. Do you have any suggestions on any innovative practices or attitudes that can be adopted for the betterment of the environment?

How effective did you think the educational video on climate change was?

Not Effective	Could be better	Neutral	Somewhat effective	Very Effective
1	2	3	4	5

**ANNEXURE – IV**

**HANDOUTS**

**How does Climate Change impact us?**

Climate Change is linked to

- Freshwater shortage
- Extreme weather events
- Drought
- Diseases related to temperature & water pollution
- Displacement of people
- Food shortage

**It's the only home we have, let's protect it. Every action counts!**

KAHER  
J.N. MEDICAL COLLEGE, BELAGAVI  
DEPARTMENT OF COMMUNITY  
MEDICINE

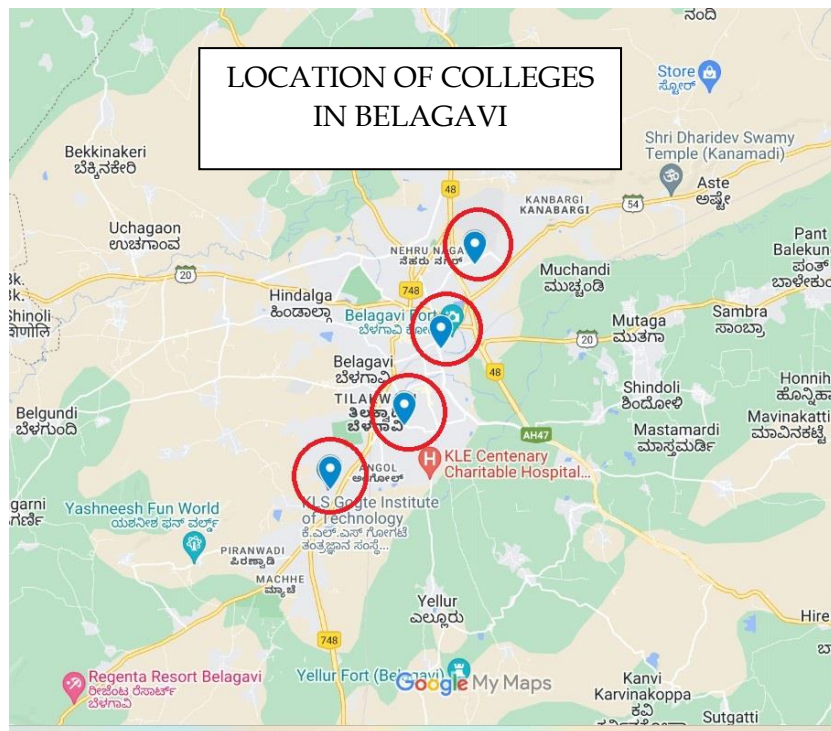
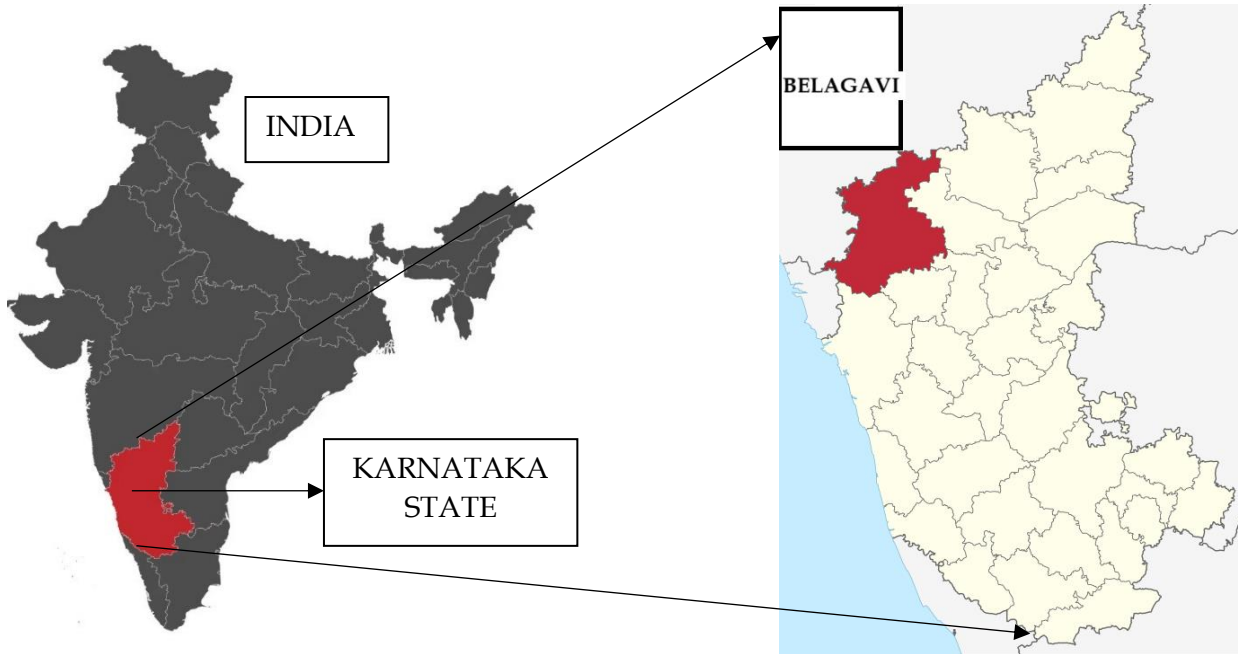
**SO WHAT CAN I DO?**

**There is no PLANet B**

1. Reduce use of plastics
2. Recycle and Reuse whenever possible
3. Use public transport
4. Turn off lights/devices when not in use
5. Use cleaner, renewable sources of energy
6. Carry your own bag for shopping
7. Use energy efficient appliances
8. Stop overnight charging of phones
9. Plant a tree
10. Practice saving water

**ANNEXURE – V**

**MAPS**



## ANNEXURE VI – PHOTOS

1. Students of KLS Raja Lakhamgouda Law College getting briefed on the study



2. Students of Gogte Institute of Technology answering the pre-test



3. Students of Sangolli Rayanna College attending the intervention



# ANNEXURE VII MASTERCHART SOCIODEMOGRAPHY

Sl.NO	Age	Gender	Residence	Course	Income	Total Family Members	PCI	SES	Category	Sl.NO	Age	Gender	Residence	Course	Income	Total Family Members	PCI	SES	Category	Sl.NO	Age	Gender	Residence	Course	Income	Total Family Members	PCI	SES	Category	Sl.NO	Age	Gender	Residence	Course	Income	Total Family Members	PCI	SES	Category	
1	18	1	1	2	20000	5	4000	3	2	81	23	2	2	2	25000	8	3125	3	1	161	18	2	1	3	5000	5	1000	5	1	241	18	1	2	4	2000	3	667	5	3	
2	19	1	1	2	80000	4	20000	1	1	82	19	1	1	2	10000	8	1250	5	1	162	20	1	1	3	20000	4	5000	2	1	242	19	1	1	4	1000	3	333	5	1	
3	19	1	2	2	4000	6	1500	5	1	83	22	2	1	2	15000	5	3000	3	1	163	20	1	2	3	10000	4	2500	4	1	243	22	2	2	4	2000	5	400	5	3	
4	23	1	1	2	10000	4	2500	4	3	84	23	2	1	2	15000	5	3000	3	1	164	20	1	1	3	15000	6	2500	4	1	244	18	2	2	4	8000	8	1000	5	1	
5	20	2	1	2	5000	6	833	5	1	85	21	2	1	2	30000	4	7500	2	1	165	18	1	2	3	30000	3	10000	1	1	245	22	2	2	4	5000	4	1250	5	1	
6	18	2	1	2	10000	4	2500	4	1	86	19	1	1	2	10000	8	1250	5	1	166	20	1	1	3	15000	3	5000	2	1	246	23	2	1	4	6000	6	1000	5	1	
7	19	1	2	2	8000	6	1500	5	1	87	18	2	1	2	10000	4	1000	4	1	167	21	2	1	3	15000	4	3750	3	1	247	18	2	1	4	7500	8	1250	4	1	
8	20	2	1	2	3000	7	429	5	1	88	22	2	1	2	25000	3	8333	2	1	168	18	2	1	3	25000	8	3125	3	1	248	23	2	1	4	7000	8	875	5	3	
9	23	1	2	2	25000	8	3125	5	3	89	20	2	1	2	15000	5	3000	3	1	169	20	1	1	3	20000	3	6667	2	1	249	20	2	2	4	7000	8	875	5	1	
10	22	1	1	2	5000	8	625	5	3	90	23	2	1	2	5000	3	1667	4	1	170	21	1	1	3	30000	4	7500	2	1	250	22	2	1	4	4000	5	800	5	1	
11	20	2	1	2	2000	8	625	5	1	91	20	1	1	1	10000	4	2500	4	3	171	20	2	2	3	25000	4	6250	2	3	251	23	1	1	4	2000	3	286	5	1	
12	21	1	2	2	25000	3	8333	2	1	92	18	1	2	1	1	5000	6	833	5	1	172	23	2	1	3	15000	7	2143	4	1	252	21	1	1	4	3000	5	600	5	1
13	20	2	1	2	10000	6	1667	4	1	93	20	1	2	1	5000	5	1000	5	1	173	23	2	1	3	5000	5	1000	5	1	253	19	1	1	4	4000	3	1333	5	1	
14	22	2	1	2	10000	7	1429	4	1	94	21	1	1	1	15000	3	5000	2	1	174	18	1	1	3	20000	5	4000	3	1	254	22	2	1	4	2000	6	333	5	1	
15	23	1	1	2	10000	3	3333	3	1	95	21	1	1	1	15000	7	2143	4	1	175	21	2	1	3	30000	8	3750	3	1	255	18	2	2	4	7000	8	875	5	1	
16	21	2	1	2	30000	6	5000	2	1	96	20	1	1	1	15000	4	3750	5	1	176	22	1	1	3	30000	3	10000	3	1	256	21	2	2	4	2000	4	500	5	3	
17	23	1	1	2	20000	4	5000	2	1	97	21	2	2	1	5000	6	833	5	1	177	20	1	1	3	20000	5	4000	3	1	257	18	1	1	4	2000	8	250	5	1	
18	18	2	1	2	20000	7	2857	3	1	98	23	2	1	1	15000	7	2143	4	1	178	18	1	1	3	20000	5	4000	3	1	258	22	2	1	4	7000	6	1167	5	1	
19	19	2	1	2	25000	5	5000	2	2	99	22	1	1	1	5000	4	1250	5	1	179	21	1	2	3	20000	3	6667	2	1	259	18	1	1	4	3000	5	600	5	1	
20	19	1	1	2	25000	6	4167	3	1	100	23	2	1	1	5000	8	625	5	3	180	22	1	1	3	20000	6	3333	3	1	260	20	1	1	4	1000	3	333	5	1	
21	23	2	1	2	20000	7	2857	3	1	101	18	2	1	1	10000	3	3333	3	1	181	22	2	1	3	5000	4	1250	5	1	261	20	1	1	4	7000	3	2333	4	3	
22	21	1	1	2	5000	4	1250	5	1	102	21	1	2	1	25000	4	6250	2	1	182	19	1	1	3	10000	6	1667	4	1	262	19	2	2	4	8000	3	2667	4	1	
23	20	1	1	2	25000	4	6250	2	1	103	23	2	2	1	20000	4	5000	2	1	183	18	1	1	3	15000	4	3750	3	1	263	21	1	1	4	8000	5	1600	4	1	
24	18	1	2	2	20000	6	6667	4	1	104	23	2	2	1	25000	10	2500	4	1	184	20	2	1	3	15000	4	3750	3	1	264	20	2	1	4	2000	6	1250	4	1	
25	18	2	2	2	20000	7	2857	3	3	105	22	2	1	1	30000	5	6000	2	1	185	20	1	1	3	20000	4	5000	2	1	265	20	2	1	4	7000	7	1000	5	1	
26	19	2	1	2	20000	7	2857	3	1	106	19	2	1	1	25000	7	3571	3	1	186	21	2	1	3	15000	5	3000	3	1	266	23	2	1	4	7000	3	2333	4	1	
27	19	1	1	2	25000	5	5000	2	3	107	18	2	1	1	25000	5	5000	2	1	187	23	2	1	3	15000	8	1875	4	3	267	19	2	1	4	4000	7	571	5	1	
28	21	2	1	2	25000	7	3571	3	1	108	18	1	1	1	15000	1	2500	2	1	188	20	1	1	3	20000	1	2000	1	1	268	20	1	1	4	2000	3	333	5	1	
29	20	2	1	2	10000	8	1250	5	1	109	23	2	1	1	20000	6	3333	3	3	189	22	1	1	3	10000	5	2000	4	3	269	20	1	1	4	4000	7	571	5	3	
30	19	1	1	2	25000	7	3571	3	1	110	19	1	1	1	5000	5	1000	5	1	190	23	2	1	3	25000	6	4167	3	1	270	23	2	1	4	7000	5	1400	4	1	
31	22	2	1	2	15000	3	5000	2	1	111	21	1	1	1	10000	7	1429	4	1	191	18	1	1	3	15000	4	3750	3	1	271	18	2	2	4	5000	5	1000	5	1	
32	22	1	1	2	20000	3	6667	2	1	112	19	2	1	1	3333	3	3333	3	1	192	19	2	1	3	15000	4	3750	3	1	272	20	2	1	4	2000	6	1250	4	1	
33	20	2	1	2	10000	4	2500	4	1	113	20	1	1	1	15000	5	3000	3	1	193	18	1	1	3	20000	3	6667	2	3	273	23	2	1	4	5000	3	1667	4	1	
34	19	1	1	2	25000	3	8333	2	1	114	20	1	1	1	10000	3	3333	3	1	194	22	1	1	3	30000	5	6000	2	3	274	19	1	1	4	2000	7	286	5	1	
35	19	1	1	2	20000	6	3333	3	1	115	18	1	1	1	30000	5	6000	2	1	195	23	2	1	3	5000	6	833	5	1	275	20	1	2	4	5000	4	1250	5	1	
36	20	1	2	2	25000	7	3571	3	1	116	19	1	1	1	20000	7	2857	3	1	196	20	2	2	3	5000	10	5000	1	1	276	20	2	2	4	4000	8	500	5	1	
37	20	2	1	2	15000	8	1875	5	1	117	18	1	1	1	15000	2	2143	4	1	197	20	1	1	3	10000	4	2500	4	1	277	20	2	2	4	5000	5	1200	5	1	
38	18	1	2	2	15000	5	3000	3	1	118	19	2	2	1	20000	3	6667	2	1	198	21	2	1	3	20000	7	2857	3	1	278	20	2	2	4	4000	5	800	5	1	
39	21	1	1	2	15000	5	3000	3	3	119	18	1	1	1	25000	4	6250	2	1	199	23	2	1	3	20000	4	5000	2	1	279	23	2	2	4	6000	3	2000	4	1	
40	19	1	1	2	10000	8	1250	5	1	120	18	1	1	1	15000	7	2143	4	3	200	19	2	1	3	15000	3	3750	2	1	280	23	2	1	4	2000	3	667	5	1	
41	23	2	1	2	15000	6	2500	4	1	121	18	1	1	1	15000	5	2000	4	1	201	23	1	1	3	30000	6	5000	2	3	281	22	2	2	4	5000	7	714	5	1	
42	19	1	1	2	20000	6	3333	3	1	122	21	1	2	1	20000	5	4000	3	1	202	23	2	2	3	5000	5	1000	5	1	282	20	2	1	4	8000	3	2667	4	1	
43	20	2	1	2	15000	8	1875	4	1	123	20	1	1	1	10000	3	3333	3	1	203	21	2	1	3	20000	6	3333	3												

# ANNEXURE VII MASTERCHART KNOWLEDGE PRETEST

SLNO	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	Intelligence Score
1	1	2	2	2	2.55	1	5	3	1.4	3.64	4.2	13
2	1	2	2	2	1.55	1	1	3	1.3	3.23	3	13
3	1	2	1	4	1.55	1	2	3	1.34	3.64	3	14
4	1	2	1	1	1.55	1	4	3	1.3	3.64	3.5	13
5	1	2	1	2	1.54	1	5	3	1.4	2.46	4.3	13
6	1	2	1	2	2.25	1	4	2	1.4	2.64	3	14
7	1	2	1	3	1.24	1	2	2	1.4	3.64	3	13
8	1	1	2	2	1.24	1	3	3	2.4	3.64	3	13
9	1	2	1	3	1.24	1	1	2	2.3	3.64	3.5	13
10	1	1	1	3	1.24	1	3	3	2.3	3.64	3	14
11	1	2	2	2	1.24	1	3	3	2.4	3.64	3	14
12	1	2	1	1	1.25	1	5	3	2.3	1.62	3	13
13	1	2	2	2	1.24	1	1	3	1.3	3.64	3	14
14	1	2	1	2	1.55	1	5	2	2.4	2.63	3	13
15	1	2	1	4	1.55	1	2	2	1.4	1.6	3	11
16	1	2	1	2	1.24	1	2	1.4	1.4	1.4	3	11
17	1	2	1	1	1.24	1	4	3	2.3	1.53	2.3	15
18	1	2	1	1	1.44	1	1	2	3	3.64	4.3	14
19	1	1	1	1	1.44	1	3	2.4	1.53	3	13	
20	1	2	1	1	1.44	1	1	3	2.4	1.53	3	14
21	1	2	1	1	1.44	1	3	2.4	1.53	3	14	
22	1	2	1	1	1.24	1	3	3	1.4	3.64	3	15
23	1	2	1	2	1.25	1	3	1.5	1.4	1.4	3	15
24	1	2	2	1	1.44	1	4	3	1.4	3.4	4.3	13
25	1	1	1	2	1.44	1	3	3.2	3.4	4.3	14	
26	1	2	2	1	1.55	1	4	3	2.3	4.3	3	13
27	1	2	1	3	1.24	1	4	2	2.4	2.52	4.3	14
28	1	2	1	3	1.55	1	2	2	1.4	3.64	3	13
29	1	2	1	3	1.25	1	5	3	2.4	4.3	4.3	13
30	1	1	1	4	1.25	1	2	2	1.3	3.64	2.3	14
31	1	1	1	2	1.24	1	5	2	1.3	3.34	2.3	14
32	1	2	2	4	1.24	1	1	3	1.3	1.4	3	12
33	1	2	1	1	1.55	1	2	2	2.3	2.65	3	13
34	1	2	1	3	1.24	1	5	2	1.4	2.61	4.3	13
35	1	2	1	1	1.24	1	1	2	3	1.45	2.3	15
36	1	2	1	1	1.55	1	1	2	2.4	3.4	4.3	14
37	1	2	1	1	1.24	1	1	3	2.4	3.33	1	15
38	1	1	1	2	1.55	1	4	2	2.3	1.62	3	12
39	1	2	1	4	1.55	1	2	2	1.4	1.4	3	12
40	1	2	1	4	1.55	1	2	2	1.4	1.4	3	12
41	1	2	1	1	1.25	1	5	3	2.4	2.52	4.3	14
42	1	2	1	4	1.54	1	3	2.4	1.42	3	13	
43	1	1	1	2	1.25	1	1	2	1.3	3.64	2.3	14
44	1	2	1	4	1.55	1	5	2	1.4	3.42	3.3	14
45	1	1	1	2	1.24	1	3	3	2.3	5.26	3	13
46	1	2	1	3	1.24	1	5	2	1.3	3.64	3	14
47	1	2	2	3	1.55	1	2	3	1.3	3.64	3	13
48	1	1	1	1	1.34	1	1	2	2.4	3.42	3	13
49	1	2	1	1	1.24	1	1	1.3	3.6	2.3	13	
50	1	2	1	4	1.24	1	5	2	2.4	1.53	3	13
51	1	1	2	3	1.25	1	5	2	1.2	3.62	3	11
52	1	2	1	3	1.25	1	4	2	2.4	3.64	3	14
53	1	2	1	4	1.25	1	3	3	1.3	1.43	3	14
54	1	2	2	1	1.54	1	4	3	1.4	1.5	2.3	13
55	1	2	1	2	1.25	1	5	3	1.3	2.52	2.3	15
56	1	2	1	1	1.55	1	2	3	1.4	2.61	3	13
57	1	1	1	4	1.55	1	3	2	2.3	1.52	3	13
58	1	2	1	1	1.55	1	2	2	1.3	3.64	3	14
59	1	2	1	1	1.24	1	3	3	1.3	1.52	3	14
60	1	2	2	2	1.55	1	2	2	2.3	3.64	4.3	13
61	1	2	1	3	1.24	1	1	3	1.4	1.45	4.3	14
62	1	2	1	4	1.34	1	3	3	1.4	1.4	4.3	14
63	1	1	1	4	1.25	1	4	2	1.3	1.56	3	12
64	1	2	1	3	1.34	1	4	2	1.3	2.65	3	13
65	1	2	1	4	1.24	1	1	2	2.3	2.61	3	13
66	1	2	2	3	1.54	1	3	3	1.52	2.3	15	
67	1	2	1	4	1.34	1	2	2	2.4	2.43	3	13
68	1	2	1	4	1.24	1	5	2	2.4	3.43	3	15
69	1	1	1	2	1.34	1	1	3	2.4	2.45	4.3	12
70	1	2	1	1	1.34	1	5	2	1.4	2.43	4.3	14
71	1	2	1	2	1.34	1	4	3	1.3	2.45	2.3	15
72	1	1	1	4	1.25	1	1	2	2.4	1.65	2.3	12
73	1	1	1	4	1.54	1	3	2	1.4	2.45	4.3	12
74	1	2	1	4	1.24	1	4	3	1.4	1.46	2.3	13
75	1	2	1	2	1.55	1	4	3	2.4	3.64	3	13
76	1	2	1	4	1.24	1	3	2	1.4	3.62	2.3	14
77	1	2	1	1	1.44	1	1	3	1.4	1.4	3	14
78	1	2	1	2	1.44	1	1	2	1.4	1.4	3	13
79	1	1	2	3	1.34	1	4	2	2.3	1.53	3	14
80	1	2	1	4	1.24	1	2	3	1.3	1.46	3	12

SLNO	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	Intelligence Score
81	1	2	1	2	1.25	1	4	2	1.4	3.64	4.2	14
82	1	1	2	1	1.24	1	3	2	2.4	2.43	3	14
83	1	2	1	3	1.34	1	4	2	1.3	3.62	3	14
84	1	2	1	4	1.25	1	1	2	2.4	3.64	3	12
85	1	1	1	3	1.25	1	4	3	2.3	3.52	2.3	14
86	1	2	1	3	1.25	1	3	3	2.3	3.5	3	14
87	1	2	1	3	1.34	1	5	3	2.3	3.62	3	15
88	1	1	2	4	1.24	1	1	3	2.3	3.52	3	12
89	1	2	1	4	1.25	1	4	2	1.3	3.64	3	13
90	1	2	1	2	1.25	1	5	2	1.3	1.6	2.3	13
91	1	2	2	2	1.24	1	5	3	2.4	1.52	2.3	14
92	1	2	1	4	1.25	1	4	2	2.4	3.64	4.3	13
93	1	2	2	2	1.24	1	5	3	1.3	1.4	3	15
94	1	1	2	4	1.24	1	4	3	2.3	1.62	3	10
95	1	2	1	2	1.55	1	4	2	1.4	1.56	4.3	13
96	1	2	1	4	1.55	1	2	2	1.4	1.4	3	11
97	1	2	1	3	1.24	1	2	3	2.45	4.3	14	
98	1	2	1	2	1.25	1	1	2	2.4	3.64	3	13
99	1	2	1	3	1.44	1	5	2	2.3	3.62	2.3	15
100	1	1	2	2	1.55	1	4	2	1.3	1.4	3	14
101	1	2	1	3	1.55	1	4	3	1.3	1.45	4.3	14
102	1	2	1	4	1.34	1	2	2	2.4	3.45	1	13
103	1	2	1	3	1.25	1	2	2	1.4	3.64	3	15
104	1	2	1	3	1.34	1	4	2	2.3	3.64	4.3	14
105	1	2	1	3	1.55	1	4	3	2.3	2.61	4.3	13
106	1	2	1	4	1.55	1	5	3	2.4	3.45	2.3	14
107	1	2	1	1	1.44	1	4	2	2.5	2.65	3	15
108	1	2	1	4	1.55	1	5	2	2.4	2.66	2.3	15
109	1	2	2	2	1.55	1	5	3	1.3	1.46	2.3	12
110	1	2	1	4	1.55	1	2	3	1.4	1.4	2.3	13
111	1	2	1	1	1.24	1	4	3	2.3	3.6	2.3	13
112	1	2	1	3	1.55	1	4	3	1.3	3.62	3	14
113	1	2	1	2	1.34	1	2	3	1.3	2.53	2.3	15
114	1	2	1	4	1.25	1	3	3	2.4	3.54	4.3	13
115	1	2	1	4	1.25	1	1	2	1.4	3.64	3	14
116	1	2	1	1	1.55	1	2	2	2.4	1.45	4.3	14
117	1	2	1	1	1.55	1	2	3	1.4	2.46	4.3	13
118	1	2	1	4	1.55	1	1	2	1.3	1.64	3	12
119	1	2	1	2	1.55	1	2	2	2.4	2.66	3	14
120	1	2	2	1	1.54	1	3	2	1.4	1.4	2.3	13
121	1	2	1	4	1.25	1	3	2	2.3	3.65	3	14
122	1	2	1	3	1.55	1	3	3	1.3	1.4	4.3	13
123	1	2	1	4	1.34	1	5	2	2.3	1.5	2.3	13
124	1	1	1	1	1.34	1	1	2	1.3	3.5	3.3	13
125	1	2	2	3	1.24	1	4	2	1.4	2.53	3	13
126	1	2	1	3	1.25	1	5	2	2.3	3.58	3.3	14
127	1	2	1	2	1.44	1	5	3	1.4	3.64	3	14
128	1	2	1	2	1.55	1	1	2	1.3	2.63	3	13
129	1	2	1	2	1.55	1	1					





ANNEXURE VII

MASTERCHART ATTITUDE SCORES POST-TEST

Q. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80										
Q. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80										
Q. No.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150																				
Q. No.	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
Q. No.	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320										



