

Delivering a Carbon Literacy Workshop to Worcestershire Libraries

An Interactive Qualifying Project submitted to the Faculty of
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Abstract

Carbon literacy has an important role in the United Kingdom's (UK) goal of net zero emissions by 2050. In partnership with The University of Worcester (UW) and The Worcestershire County Council, shortened Carbon Literacy workshops were created and delivered in Worcestershire libraries. To create the workshops, key concepts were identified from the Carbon Literacy Project (CLP). Twelve workshops were delivered, two workshops at each of the six libraries in Worcestershire County. One workshop was developed for adults and one modified for families with children aged four to eight. All the family workshops had at least two families attend. Two adult workshops had attendees, with attendance varying between one and seven. Recommendations included using student volunteers from UW to deliver and facilitate the workshops, that carbon literacy material be added to all community libraries, and that the workshops be marketed with incentives.

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Authorship

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Executive Summary	AR, KA	RO
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<i>Market the Carbon Literacy Workshop</i>	KA	AR
<i>Deliver and Asses the Carbon Literacy Workshop</i>	AR	KA
<i>Developing a Teaching Guide</i>	TD	AR
Results		
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<i>Delivering and Assessing the Workshops</i>	KA	AR
Conclusions and Recommendations		
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<i>Recommendations</i>		
<i>Student Volunteers</i>	KA	AR, TD
<i>Carbon Literacy Library Section</i>	RO	AR, TD
<i>Market Using Incentives</i>	AR	KA
References	All	All
Appendix A	KA	All
Appendix B	KA	All
Appendix C	KA	All
Appendix D	KA	All
Appendix E	KA	All
Appendix F	KA, TD	All

Table of contents

Abstract.....	i
Acknowledgments.....	ii
Authorship	iii
Table of contents	iv
Executive Summary.....	vi
1.0 Introduction	1
2.0 Background	2
2.1 Global Impact of Greenhouse Gas Emissions.....	2
2.2 Greenhouse Gas Emissions in the UK.....	3
2.3 Covid-19 Caused a Decrease in Carbon Emissions.....	4
2.4 The Carbon Literacy Project	4
2.4.1 How Carbon Literacy Mitigates Environmental Impact	5
2.4.2 Learning Adaptation to make an Impact	5
3 Methodology.....	6
3.1 Develop an Abbreviated Carbon Literacy Workshop.....	6
3.2 Market the Carbon Literacy Workshop.....	6
3.3 Deliver and Assess the Carbon Literacy Workshop.....	7
3.4 Developing a Teaching Guide	8
4 Results.....	9
4.1 Marketing	9
4.2 Delivering and Assessing the Workshops.....	9
<i>Adult Workshop Survey Results</i>	9
<i>Family Session Survey Results</i>	11
<i>Observational Data</i>	14
<i>Taster Sessions</i>	14
5.0 Conclusions and Recommendations.....	15
5.1 Summary Conclusions	15
<i>Social media is the best marketing strategy</i>	15
<i>People attend workshops if they are not during work and school hours</i>	15
<i>Attendees would like to continue their understanding on carbon literacy</i>	15
<i>Activity based workshops are more engaging</i>	15
5.2 Recommendations	15

R1: Student volunteers should deliver the workshops	15
R2: Incorporate Carbon Literacy sections in Worcestershire libraries.....	16
R3: Market with incentives to attend.....	16
References	18
Appendix A Carbon Literacy Workshop – Consent Form	20
Appendix B Adult Pre-Survey.....	21
Appendix C Family Pre-Survey	23
Appendix D Adult Post-Survey.....	25
Appendix E Family Post-Survey.....	26
Appendix F Advertisements	28

Executive Summary

Introduction

Through the [2008 Climate Change Act](#), the United Kingdom (UK) set a target to significantly reduce greenhouse gas emissions by 2050 (A legal duty to act 2023). With 40% of UK greenhouse emissions coming from households, UK residents' homes have an important part to play in not exceeding the Fifth Carbon Budget (The fifth carbon budget - how every household can help ...). One program that is educating individuals to become carbon literate and to then reduce their carbon footprint is the [Carbon Literacy Program](#) (CLP), a charity that focuses on giving people the opportunity to become certified in carbon literacy through an 8-hour training program (Individual 2024). The program covers topics such as greenhouse gases and their impact on the planet and presents ways for individuals to reduce them. At the end of the program, participants pledge individual and group actions that will reduce their carbon footprint. The program provides participants with a carbon literacy certificate.

Unfortunately, the CLP certificate cannot be earned in a time shorter than 8 hours. The goal of this project was to develop and deliver an abbreviated Carbon Literacy workshop adapted to audiences attending Worcestershire libraries. To achieve this goal, four objectives were developed:

1. Develop an abbreviated carbon literacy workshop tailored for audiences at libraries in Worcestershire.
2. Market the carbon literacy workshop.
3. Deliver and assess the carbon literacy workshop.
4. Develop a teacher guide which the libraries can use to guide and conduct future workshops.

Background

The UK has recognized the urgent need to reduce carbon emissions. In response, the UK government has set targets to achieve net-zero emissions by 2050 (Department for Business, Energy & Industrial Strategy, 2021). Some approaches that the UK can adopt to address these changes are widespread public engagement, education and behavior change. (Committee on Climate Change, 2020).

Carbon Literacy incorporates awareness of the carbon costs and impacts of everyday activities, and ability and motivation to reduce emissions on an individual, community, and organizational basis. The CL program strives to foster personal responsibility and encourage individuals to act in their daily lives to support a more sustainable future.

Greenhouse gas emissions released from human, industrial, and economic activities are contributing to global warming. Carbon Dioxide contributes around 74% of these greenhouse gas emissions (Carbon Literacy Taster, 2024). Taking personal accountability and tracking emissions represents a collective positive impact of our actions on addressing

climate change and reflects the extent of human influence on the environment (Mschmitz, 2023).

While the government's current regulatory actions are important to continue reducing greenhouse gases, they alone cannot mitigate climate change. Citizens' actions are just as important; citizens must understand their carbon emissions and how to reduce their impact. Carbon Literacy Training can guide participants toward meeting the nation's goals by encouraging community engagement and actions.

[The Carbon Literacy Project](#) (CLP) is an organization that promotes climate solutions and actions through detailed training programs and well-organized events. The CL highlights sustainable change and supports individuals to use what they learned in their workplace, community, school, university, and other settings. Established in 2012 by a coalition of environmentalists, educators, and leaders, the CLP has since been at the forefront of fostering environmental awareness and action (The Carbon Literacy Project, 2024).

The Carbon Literacy course is a hybrid learning experience that includes 4 hours of self-study and 4 hours of virtual or in-person training (The Carbon Literacy Project, 2024). Individuals may struggle to complete the full carbon literacy training, due to it being an 8-hour time commitment. Also, the subject's technical components may deter those unfamiliar with carbon literacy. To address these two issues, a simplified version of the carbon literacy training was offered as a taster session. These taster sessions are an hour long, containing engaging activities such as quiz questions and a [carbon footprint calculator](#). The aim of the training when discussing mitigation is to reduce current greenhouse gas emissions, prevent new greenhouse gas emissions, and conserve sinks and reservoirs (Carbon Literacy Taster, 2024).

Methods

We developed the abbreviated carbon literacy workshop through the following methods:

1. Take the full [carbon literacy training](#) to become familiar with the program.
2. Leverage sponsor insights and training materials to identify the Carbon Literacy Program's key messages and goals.
3. Develop a concise and engaging version of the Carbon Literacy Program.

We marketed the workshop through a variety of sources, including fliers, social media, and table sitting at the libraries. Fliers were designed to target both adults and families, included the dates of the workshops, and contained a QR code linking individuals to Eventbrite allowing them to sign up for the workshops. We sat at a table in the libraries with the fliers displayed, explaining our purpose to those visiting the libraries and encouraging them to participate in an interactive activity. The libraries' Facebook pages posted advertisements for our workshop, containing the fliers along with key information about the events.

The workshops were delivered using various methods to engage participants and enhance their grasp of sustainable practices, such as interactive training sessions to encourage active participation and problem-solving skills. We demonstrated carbon-friendly practices as examples for participants to follow and integrate elements of gamification to enhance motivation and engagement. During our workshops we evaluated the participants' level of interest and engagement. We provided participants with a pre and post survey (See appendix A Through D). Once we received the information from all groups of participants, we conducted a comparative analysis of the surveys and used the participants' feedback to improve future workshops.

We then created a guide to help library staff deliver carbon literacy workshops. We proposed including objectives of the workshop, background information needed to facilitate the workshop, facts that will help the discussion stay on track, and a script for the activities. Throughout the workshop, the facilitator will encourage participants to make personal pledges to continue their climate-friendly actions. By equipping community members with this toolkit, we aim to empower them to effectively share carbon literacy knowledge and inspire climate action at the local level.

Results

The survey question (Appendix B and D) asked participants "What advertisement brought you to attend this workshop?". The data we gathered from the surveys showed that out of the 5 marketing strategies we implemented social media and hearing the information from someone were our best methods for advertisement.

For our adult workshop survey results we only had 6 participants fill out a survey. From the surveys, we found that everyone attended the workshop to gain resources to reduce their carbon footprint and half had heard of carbon literacy before. Table 1 below shows the results from the pre-workshop survey. We asked the adults to answer a few prompts on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.

Pre-Workshop Questions (Scale of 1-5)	Participants					
	#1	#2	#3	#4	#5	#6
I could describe carbon emissions to someone else	4	4	4	4	4	5
I am concerned about global climate change	5	4	5	5	5	5
Individuals have the power to make a positive impact on climate change	5	5	3	4	5	5
Corporations have more power than I to reduce the overall carbon emissions	4	5	5	5	3	5
I recycle to reduce my carbon footprint	5	5	4	5	5	3
I wish I did more to reduce my carbon footprint	3	4	5	5	4	5

Table 1: Adult session Pre-Workshop survey questions

Table 1 and 2 emphasize the different responses we received by color coding the answers. Yellow represents neutral, light green represents agree, green represents strongly agree. These results show us that the audience was not our target audience since the

workshop was created for individuals who have little to no understanding of carbon literacy. Table 2 below shows the answers to the post-workshop survey questions.

Post-Workshop Questions (Scale of 1-5)	Participants					
	#1	#2	#3	#4	#5	#6
I could describe carbon emissions to someone else.	4	4	4	4	4	4
I am more concerned about global climate change.	4	5	5	3	5	5
Individuals have the power to make a positive impact on climate change.	5	3	5	5	4	5
Corporations have more power than I to reduce the overall carbon emissions.	4	5	4	4	4	5
I will recycle to reduce my carbon footprint.	5	5	4	5	5	5
I wish I did more to reduce my carbon footprint.	5	4	5	5	3	5

Table 2: Adult Session Workshop survey questions.

When comparing table 1 to table 2, we see that these results are not similar enough to state that our workshop increased people’s concern and willingness to make a change.

For our adult workshop survey results we had 13 out of the 19 adults fill out the survey we provided during the workshop. We had a total of 19 adults and 24 children attend our workshops. The session at the Malvern library had the most families attend, with 4 families. From the 13 surveys we found that:

- 12 adults usually attend the library to borrow books
- 5 adults had heard the term carbon literacy before the workshop
- 10 adults understood carbon literacy after the workshop
- 8 adults knew that the UK is trying to hit zero carbon emissions by 2050

Most of the individuals also responded that they wanted to continue their knowledge on carbon literacy. The data from the surveys show that our workshop was effective at teaching individuals about carbon literacy and getting them to want to learn more about it.

At the adult session we had a carbon footprint calculator, and a quiz, that we adapted from the taster session, with multiple choice questions. During the use of the [carbon footprint calculator](#), the participants were encouraged to converse amongst each other. After the first two workshops, we created a new question that contained 4 correct answers, but we asked participants which choice reduced the most carbon emissions.

At the family session we had a coloring activity, a story time and a planting activity. The coloring activity had some of the children disengaged from the workshop. The children did interact with the Greta Thunberg book we read because they had prior knowledge of Greta Thunberg. During the planting activities both the adults and children were engaged and excited to plant their herbs.

We delivered 6 taster sessions to the staff at several Worcestershire libraries. The taster sessions slide show was adapted for both the University of Worcester and for library staff by Katy Boom, Sian Evans, and Gill Slater. We observed that the library staff attended

the sessions in groups, each group from a different library. Surprisingly, the library staff did not have their own computers, which made it difficult to do some of the activities. One of the participants reached out a few days later to learn more about taking the full 8-hour carbon literacy training.

Conclusion and Recommendations

In conclusion, we discovered that social media was the most efficient way to reach our attendance. Utilizing the power of social media is an unrivaled marketing tactic for promoting carbon literacy. We found that people attend workshops if they are not during work and school hours. The only adult workshop to have outside participants was the one that ran on Saturday. Our family workshops all ran outside school and work hours, we had attendees show up to every family workshop we facilitated.

We found that attendees would like to continue their understanding of carbon literacy. When surveying the audience at the end of our workshops, 16 of the 19 individuals replied “yes” to the questions “Are you interested in continuing your training on carbon literacy?”.

When analyzing participants during the workshop, we found a higher level of engagement during the activities. Most discussion between participants came from activities such as the carbon footprint calculator during the adult workshop, the story time during the family session, and the planting of an herb for the families to bring home.

We propose three recommendations;

1. Student volunteers should deliver the workshops,
2. Worcestershire libraries should create carbon literacy sections
3. Marketing should focus on incentives for the attendees.

Students who attend the University of Worcester (UW) and are part of the University’s sustainability groups should deliver these workshops. We recommend that the University of Worcester promote this volunteer opportunity through their [Volunteer Opportunities website](#). A great group to facilitate the workshops would be the [Green Impact Project assistants](#) that attend the UW.

Libraries across Worcestershire should incorporate carbon literacy sections in their libraries. By providing a display case with books covering topics related to carbon literacy, such as sustainability, carbon emissions, and global warming, residents will grow to understand how to take practical action and reduce their carbon footprint.

Marketing for carbon literacy related events should focus on providing incentives for the public to attend. Based on the low adult turnout at the workshops, we believe that the public needs more reason to attend a carbon literacy workshop. First, the marketing should mention that the workshop will provide climate co-benefits, which are additional beneficial outcomes from climate friendly actions that are not directly related to climate change mitigation. The marketing should also mention that by taking the full CLP training, individuals can receive a certification declaring them Carbon Literate.

1.0 Introduction

Through the [2008 Climate Change Act](#), the United Kingdom (UK) set a target to significantly reduce greenhouse gas emissions by 2050 (*A legal duty to act 2023*). In 2016, the [Fifth Carbon budget](#) created a maximum carbon emission limit of 1.725 million tonnes of carbon dioxide for the 5-year period between 2028 and 2032 (*The Carbon Budget Order 2016*). With 40% of UK greenhouse emissions coming from households, UK residents' homes have an important part to play in not exceeding the Fifth Carbon Budget (*The fifth carbon budget - how every household can help ...*).

One program that is educating individuals to become carbon literate and to then reduce their carbon footprint is the [Carbon Literacy Program](#) (CLP), a charity that focuses on giving people the opportunity to become certified in carbon literacy through an 8-hour training program (*Individual 2024*). The program covers topics such as greenhouse gases and their impact on the planet and presents ways for individuals to reduce them. At the end of the program, participants pledge individual and group actions to reduce their carbon footprint. The program provides participants with a carbon literacy certificate.

Unfortunately, the CLP certificate cannot be earned in a time shorter than completing the full 8-hour program. In attempts to address this issue locally, two student research projects were completed that focused on the development and delivery of abbreviated carbon literacy workshops in libraries within Worcestershire. In 2022, the project goal was to promote carbon literacy training in Worcestershire, using library resources to help reduce the region's carbon footprint. The research team focused on whether the audience would continue to pursue an interest in carbon literacy after attending a short taster program (Pedersen et al., *Carbon Literacy in Worcestershire Libraries 2022*). The goal of the 2023 project was to assist Worcestershire libraries in creating, delivering, and evaluating abbreviated lesson plans, to promote carbon literacy and provide changes to improve individuals carbon footprint. This research team focused on retaining the audience's attention during the workshop. (Thornton et al., *Delivering Carbon Literacy in Worcestershire Libraries 2023*).

The goal of this project was to develop and deliver an abbreviated Carbon Literacy workshop adapted to audiences attending Worcestershire libraries. To achieve this goal, four objectives were developed:

1. Develop an abbreviated carbon literacy workshop tailored for audiences at libraries in Worcestershire.
2. Market the carbon literacy workshop.
3. Deliver and assess the carbon literacy workshop.
4. Develop a teacher guide which the libraries can use to guide and conduct future workshops.

2.0 Background

The increase of greenhouse gases in Earth's atmosphere, primarily due to human activities, has led to significant global climate change. The United Kingdom, along with many other nations, has recognized the urgent need to reduce carbon emissions to mitigate the effects of climate change. In response to this global challenge, the UK government has set ambitious targets to achieve net-zero emissions by 2050 (Department for Business, Energy & Industrial Strategy, 2021).

England, as the largest country within the UK, has an important role in meeting these emission reduction goals. As a modern highly advanced nation, the UK faces several challenges in its efforts to decarbonize with 78% of their high energy consumption coming from burning fossil fuels (Accelerating the transition from fossil fuels, 2023). Some approaches that the UK can adopt to address these changes are widespread public engagement, education and behavior change. (Committee on Climate Change, 2020).

In terms of education, Carbon Literacy, as defined by the Carbon Literacy (CL) Program, incorporates an awareness of the carbon costs, and the impacts of everyday activities as well as the ability and motivation to reduce emissions on an individual, community, and organizational basis. In addition to its core educational focus on carbon emissions, the Carbon Literacy Project addresses a range of related environmental topics, such as sustainable energy practices, waste management, and conservation efforts. By providing a full understanding of these issues, the CL program strives to foster personal responsibility and encourage individuals to act in their daily lives to support a more sustainable future.

2.1 Global Impact of Greenhouse Gas Emissions

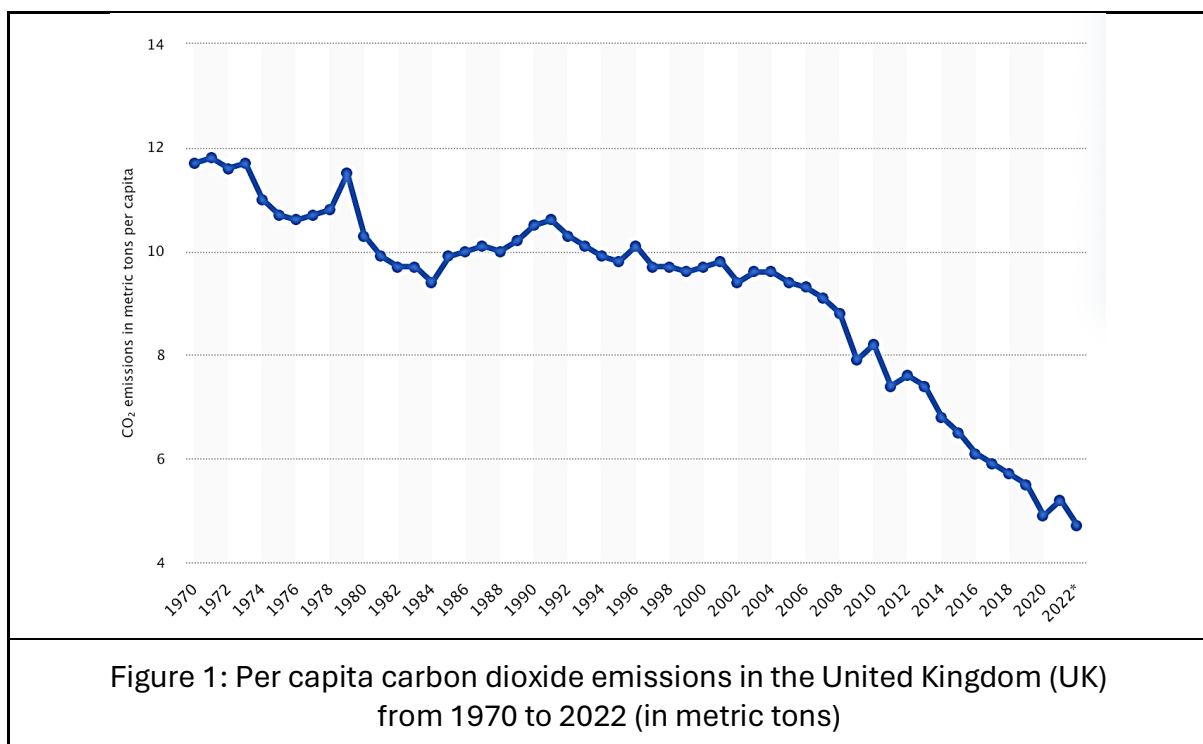
Greenhouse gas emissions released from human, industrial, and economic activities are contributing to global warming. Carbon Dioxide contributes around 74% of these greenhouse gas emissions while methane (17%), nitrous oxide (6%), and fluorinated gases (f-gases) (2%), make up the rest (Carbon Literacy Taster, 2024). When these gases start building up in the atmosphere, intense droughts, heat waves, and other extreme weather events (cyclones, blizzards, and rainstorms) can intensify and cause more of an impact. These events will only worsen as carbon increases in the atmosphere and highlights the importance for individuals to be aware of and minimize their carbon footprint. Taking personal accountability and tracking emissions represents a collective positive impact of our actions on addressing climate change and reflects the extent of human influence on the environment (Mschmitz, 2023).

Tracking our carbon footprint is not just about taking personal responsibility as the repercussions exist outside of environmental impact. For example, the economic consequences of uncontrolled greenhouse gas emissions can be consequential, leading to increased costs associated with ensuring water supply and quality, agricultural production, and mitigation of crop failures. Consider the Australian bushfires of 2019-2020, where the

intensity of the fires was likely correlated to the effects of climate change and connection between environmental factors and economic impacts, highlighting the urgency of addressing climate change (Smoot, 2023). This correlation is just one of many examples that presents the need for urgency when addressing climate change.

2.2 Greenhouse Gas Emissions in the UK

The UK has an overall goal to decrease their greenhouse gas emissions over time with a focus on decreasing their carbon emissions. Figure 1 shows how carbon emissions have reduced from 1970 to 2022. Over five decades, it can be observed that the UK has made major strides to reduce their carbon footprint, heavily influenced by societal and economic changes made by the government.



More recently, the average per capita CO₂ emissions in the UK have fluctuated, the average carbon dioxide a person emits per capita was 5.5 metric tons in 2019, 4.9 metric tons in 2020, 5.2 metric tons in 2021, and 4.7 metric tons in 2022 (Ritchie et al., 2020). The decrease in emissions observed in 2022 can be primarily attributed to reduced gas consumption for heating buildings, driven by milder weather conditions compared to other years (Waite, 2021).

While the government's current regulatory actions are important to continue reducing greenhouse gases, they alone cannot mitigate climate change. Citizens' actions are just as important; to get them involved they must understand their carbon emissions and how to reduce their impact. Carbon Literacy Training can guide participants toward meeting the nation's goals by encouraging community engagement and actions.

2.3 Covid-19 Caused a Decrease in Carbon Emissions

The Covid-19 pandemic has provided insight into how to lower carbon emissions in the UK as individuals were forced into a lifestyle that reduced their footprints. An estimated 426.5 million metric tons of carbon dioxide equivalent (MtCO_{2e}) were produced in the UK in 2021 (Christenson, 2023). While 5.3% less carbon was emitted than predicted for 2019, this is still a 5.0% increase from 2020. The United Kingdom went into their first lockdown in March of 2020 and from March to November slowly reopened places just to go into a second lockdown at the start of November. (*Timeline of UK coronavirus lockdowns, March 2020 to March 2021*) Additionally, as lockdowns relaxed nationwide, road transportation increased, contributing to emissions increasing in 2021 (Waite, 2021). These findings are important because they show the lower greenhouse gas emissions observed during the Covid lockdowns of 2020, compared to 2019 and 2021, when lifestyle changes are made.

2.4 The Carbon Literacy Project

[The Carbon Literacy Project](#) (CLP) is an organization that promotes climate solutions and actions through detailed training programs and well-organized events. The CLP focuses on more than just small personal changes, it highlights sustainable change and supports individuals to use what they learned in their workplace, community, school, university, place of worship and other settings. Established in 2012 by a coalition of environmentalists, educators, and leaders, the CLP has since been at the forefront of fostering environmental awareness and action (The Carbon Literacy Project, 2024).

The Carbon Literacy course is a hybrid learning experience that includes 4 hours of self-study and 4 hours of virtual or in-person training (The Carbon Literacy Project, 2024). Participants gain a better understanding of climate change and the environmental consequences of their daily actions. The engaging and interactive training enables attendees to map their own carbon footprint and receive insights and motivation to minimize personal and workplace emissions.

Individuals may struggle to complete the full carbon literacy training, due to it being an 8-hour time commitment. Exploring the complexities of carbon emissions, mitigation techniques, and sustainable practices requires 8 hours of time dedicated to carbon literacy training, which may be difficult for individuals already burdened with other responsibilities. Furthermore, the subject's technical components may deter those unfamiliar with carbon literacy.

To address these two issues, a simplified version of the carbon literacy training was offered as a taster session. These taster sessions are an hour long, containing engaging activities such as quiz questions and a [carbon footprint calculator](#) which estimates an individual carbon footprint in annual tonnes. These activities allow for conversation, rather than lecturing to the audience.

2.4.1 How Carbon Literacy Mitigates Environmental Impact

Through the Carbon Literacy Training, individuals are introduced to sustainability and environmental values, and these learnings can help mitigate climate change. Mitigation in the context of climate change and carbon literacy categorizes activities that will help reduce the rate of global warming and its impact on the planet. The aim of the training when discussing mitigation is to reduce current greenhouse gas emissions, prevent new greenhouse gas emissions, and conserve sinks and reservoirs (Carbon Literacy Taster, 2024).

There are no one-size-fits-all solutions when it comes to mitigating climate change, but with collective effort and ideas, there have been major strides made toward achieving this goal. Some high- and low-tech solutions include using renewable energy and heat networks, as well as using electric heat pumps for domestic heating and electric vehicles for transportation. Also, hydrogen is another possible solution that can be used for hydrogen-electric vehicles and boilers. Deforestation is of major concern as well, due to how much carbon our trees absorb, so replanting and rebuilding these ecosystems is crucial to reducing the carbon released into the atmosphere (Carbon Literacy Taster, 2024). By putting all these approaches together, mitigating climate change is an achievable reality that can be made possible with community and effort.

2.4.2 Learning Adaptation to make an Impact

While mitigation is key when addressing climate change, adaptation is an additional concept that carbon literacy incorporates into their training. Adaptation can be defined as adjusting our decisions, activities, and societal structures to respond to the anticipated shifts in the climate (Carbon Literacy Taster, 2024). Adaptation covers reducing the damage the changing climate will bring, reducing impact on the world's most vulnerable and at-risk communities, and additionally taking advantage of potential advantages of a shifting climate to achieve the above. When discussing adaptation, it's important to address how climate impacts are ongoing and global temperatures will continue unless we use our understandings from adaptation and mitigation to slow down and reduce the impact of climate change.

3 Methodology

The goal of this project was to deliver an abbreviated Carbon Literacy workshop adapted to audiences attending Worcestershire area libraries. To achieve this goal, we identified the following objectives:

1. Develop an abbreviated carbon literacy workshop tailored for audiences at libraries in the Worcestershire Area.
2. Market the carbon literacy workshop.
3. Deliver and assess the carbon literacy workshop.
4. Develop a teacher guide which the libraries can use to guide and conduct future workshops.

The methods associated with each of these objectives are detailed below.

3.1 Develop an Abbreviated Carbon Literacy Workshop

When developing the abbreviated carbon literacy workshop, we addressed the following methods:

1. Take the full [carbon literacy training](#) to become familiar with the program
2. Leverage sponsor insights and training materials to identify the CL program's key messages and goals.
3. Develop a concise and engaging version of the Carbon Literacy program.
 - a. Create a new presentation that specifically covers key carbon literacy aspects, while incorporating interactive activities to enhance engagement.
 - b. For adults, the workshop will include discussion-based activities for deeper understanding.
 - c. For families and younger audiences, hands-on activities will make learning fun and applicable to real life. This dual approach ensures the workshop is informative and engaging for all ages.

3.2 Market the Carbon Literacy Workshop

To achieve this objective, we proposed to market the workshop through a variety of sources, including fliers, social media, and table sitting at the libraries. Fliers were designed to target both adults and families because of the different target audiences of our two workshops. The fliers included the dates of the workshops and what was expected to take place at these workshops. The flier also contained a QR code that will link individuals to Eventbrite allowing them to sign up for the workshops.

Once the fliers were created, we sat at a table with the fliers displayed. These table sittings took place in the libraries before each workshop to explain our purpose to those visiting the library. The table also contained an interactive activity to start up a conversation about carbon literacy with individuals passing by. In addition to table sitting, we also had Facebook advertisements for our workshops posted on each of the libraries' Facebook pages. This post contained the fliers along with a short message to get the individual's

attention. We proposed to ask during the workshops which advertisement brought the attendees to the event.

3.3 Deliver and Assess the Carbon Literacy Workshop

Conducting our carbon literacy workshops involved various methods to engage participants and enhance their grasp of sustainable practices. For example, we proposed to utilize interactive training workshops to encourage active participation and problem-solving skills. We demonstrated carbon-friendly practices as concrete examples for participants to follow, integrated elements of gamification to enhance motivation and engagement, and formed learning groups to promote collaboration among the participants.

During our workshops we evaluated the participants' level of interest and engagement by observing eye contact, level of participation, questions asked, level of attention, and other signs of engagement. During our delivery of the Carbon Literacy workshops, half of the team observed the attendees while the other half presented. We rotated the roles, so it was not always the same people presenting and observing. Our analysis of these observations along with more research helped determine solutions that improved engagement in future workshops.

Prior to, and after we administered the Carbon Literacy workshop at each of the 6 libraries within Worcestershire County, we provided participants with a pre and post survey (See appendix A Through D). This survey gauged what the participants retained, what they learned, what we could improve on, and how they plan to use what they learned in the future. It also included a consent portion to ensure the information we received could be used in our and future research.

Once we received the information from all 12 groups of participants¹, we conducted a comparative analysis of the surveys to see how much each group retained, learned, and planned to do on average compared to other groups. This allowed us to analyze how the group's environment impacted what they took away from the workshop. With this information, we conducted follow-up surveys that further showed us the impact the lesson had on the individuals. We used the participants' feedback for future programs and used the information to create suggestions for future workshops. We then provided our sponsors with ways to improve future programs based on the feedback.

We developed a connection between both the data we have on the participants and a way to communicate with the participants if needed. This connection was established using a form where participants could leave behind contact information and in a consent form. This was for our sponsors, the library managers and library staff continuing the workshops, and for any future IQP groups working on the project if there continues to be any. By agreeing to be contacted, the 6-month follow-up can be conducted.

¹ 6 libraries with 2 workshops each.

3.4 Developing a Teaching Guide

To achieve this objective, we created a scripted plan to help library staff deliver carbon literacy workshops. We propose to include the following elements in this script:

1. Objectives of the workshop
2. Background information needed to facilitate the workshop
3. Facts that will help the discussion stay on track
4. Script for the activities

The script covers a range of topics including the definition for uncommon terms and the concept of carbon literacy. It then explains the science behind carbon emissions and climate change, using visuals and data to demonstrate the urgency of the issue. The presentation also features simple, actionable steps participants can take to reduce their environmental impact, such as biking, eating less meat, and carpooling to work. Throughout the workshop, the facilitator will encourage participants to make personal pledges to continue their climate-friendly actions. By equipping community members with this toolkit, we aim to empower them to effectively share carbon literacy knowledge and inspire climate action at the local level.

4 Results

This section presents the results from surveys, testing different methods of marketing, and workshop delivery.

4.1 Marketing

We surveyed the attendees on what marketing strategy interested them sufficiently to come to the workshop. The survey question (Appendix B and D) asked participants "What advertisement brought you to attend this workshop?" with the responses allowed being Library Television Advertisements, Library Website Advertisements, Library email/newsletter, Heard from someone else, and Other.

When analyzing the results from the adult workshop surveys we found that 5 out of the 6 participants learned about our workshops because they heard about it from someone else. When analyzing the results from our family workshop surveys, we found that 6 out of the 13 found out about our workshop through the libraries social media and 5 out of the 13 adult participants heard about our workshop because through someone. This data shows us that out of the 5 marketing strategies we implemented social media and hearing the information from someone were our best methods for advertisement.

4.2 Delivering and Assessing the Workshops

We created two workshops; one workshop was for adults while the other was for families with kids aged 4 to 8. After realizing that most adult workshops had no participants, we decided to deliver taster sessions to library staff.

Adult Workshop Survey Results

Out of our 6 adult workshops, only 2 workshops had participants. The Evesham workshop had 1 library staff attend. The Malvern workshop had 7 participants, 1 being the library manager. We had 6 participants fill out a survey. From the surveys we found the following:

- 4 of the 6 usually attend the library for special events
- 6 attended the workshop to gain resources to reduce their carbon footprint
- 3 heard of carbon literacy prior to the workshop
- 6 knew the UK is trying to achieve zero carbon emissions by 2050

Table 1 below shows the results from the pre-workshop survey. We asked the adults to answer a few prompts on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.

Pre-Workshop Questions (Scale of 1-5)	Participants					
	#1	#2	#3	#4	#5	#6
I could describe carbon emissions to someone else	4	4	4	4	4	5
I am concerned about global climate change	5	4	5	5	5	5
Individuals have the power to make a positive impact on climate change	5	5	3	4	5	5
Corporations have more power than I to reduce the overall carbon emissions	4	5	5	5	3	5
I recycle to reduce my carbon footprint	5	5	4	5	5	3
I wish I did more to reduce my carbon footprint	3	4	5	5	4	5

Table 1: Adult session Pre-Workshop survey questions

Table 1 emphasizes the different responses we received by color coding the answers. Yellow represents neutral, light green represents agree, green represents strongly agree. The difference is to clearly show how none of the participants disagreed with the statements. The participants came into the workshop with an overall understanding of climate change and carbon emissions. These results show us that the audience was not our target audience since the workshop was created for individuals who have little to no understanding of topics such as carbon footprints, carbon emissions and climate change.

Table 2 below shows the answers to the post-workshop survey questions. The format of the survey was identical to our pre workshop survey to make it easy to analyze what people learned from our workshop.

Post-Workshop Questions (Scale of 1-5)	Participants					
	#1	#2	#3	#4	#5	#6
I could describe carbon emissions to someone else.	4	4	4	4	4	4
I am more concerned about global climate change.	4	5	5	3	5	5
Individuals have the power to make a positive impact on climate change.	5	3	5	5	4	5
Corporations have more power than I to reduce the overall carbon emissions.	4	5	4	4	4	5
I will recycle to reduce my carbon footprint.	5	5	4	5	5	5
I wish I did more to reduce my carbon footprint.	5	4	5	5	3	5

Table 2: Adult Session Workshop survey questions.

When comparing table 1 to table 2, we see each participant had a different result from the workshop. Participant one wish they did more to reduce their carbon emissions after the workshop. Participant two believed that individuals have the power to make a positive impact on climate change prior to the workshop but were neutral about the situation afterwards. Participant three agreed more to that same statement after the workshop. Participant four were already concerned about climate change prior to the workshop, so the workshop did not make them more concerned. Participant five wished they did more to reduce their carbon footprint prior to the workshop. Participant six's results stayed the same. These results aren't similar enough to state that our workshop

increased people’s concern and willingness to make a change. The main reason is because the individuals came in with a prior knowledge of carbon related topics.

Family Session Survey Results

All our family workshops had participants attend. The table below shows how many participants attended each of our 6 workshops.

Location	Time	Date	Adults	Children
Evesham	15:30	March 22nd, 2024	3	3
Malvern	11:00	March 23rd, 2024	4	5
Redditch	15:30	March 26th, 2024	3	5
Bromsgrove	15:30	March 28th, 2024	5	4
Kidderminster	15:30	April 3rd, 2024	2	4
The Hive	14:30	April 13th, 2024	2	3

Table 3: Attendance at the Family sessions

The session at Malvern had the most families attend, with 4 families. Out of the 19 adults we had 13 adults fill out the survey we provided during the workshop. Some parents abstained from the survey or attended the workshop late. From the 13 surveys we found that:

- 12 adults usually attend the library to borrow books
- 5 adults had heard the term carbon literacy before the workshop
- 10 adults understood carbon literacy after the workshop
- 8 adults knew that the UK is trying to hit zero carbon emissions by 2050

We then asked the adults to answer a few prompts on a scale of 1 to 5 where 1 was strongly disagree and 5 was strongly agree. Below are the results of each prompt.

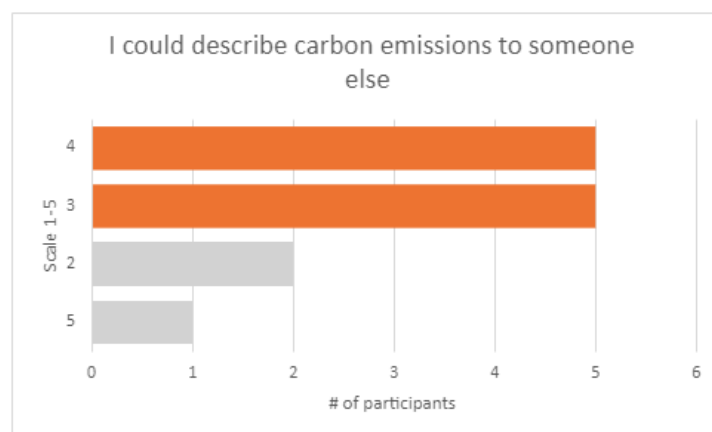


Figure 2: Results from prompt
“I could describe carbon emissions to someone else”

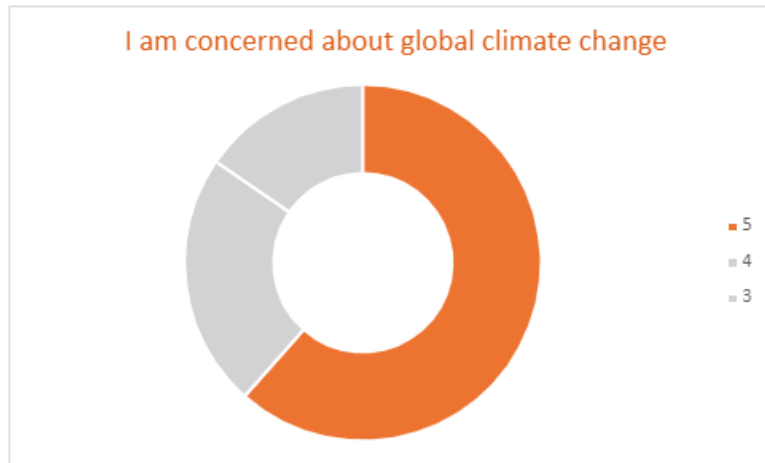


Figure 3: Results from prompt “I am concerned about global climate change”

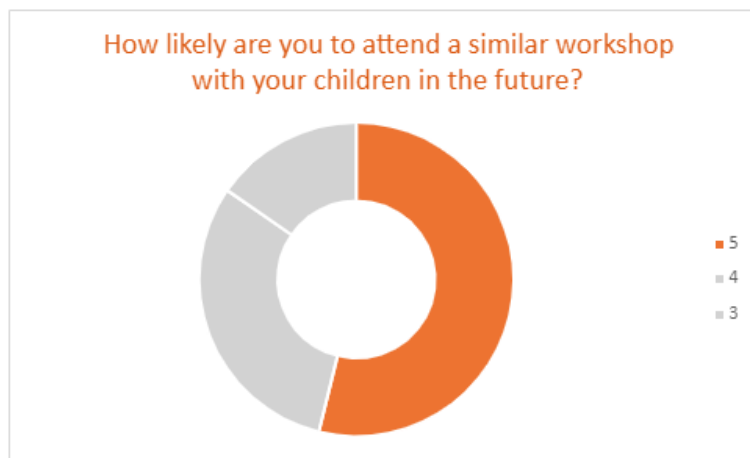


Figure 4: Results from prompt “How likely are you to attend a similar workshop with your children in the future?”

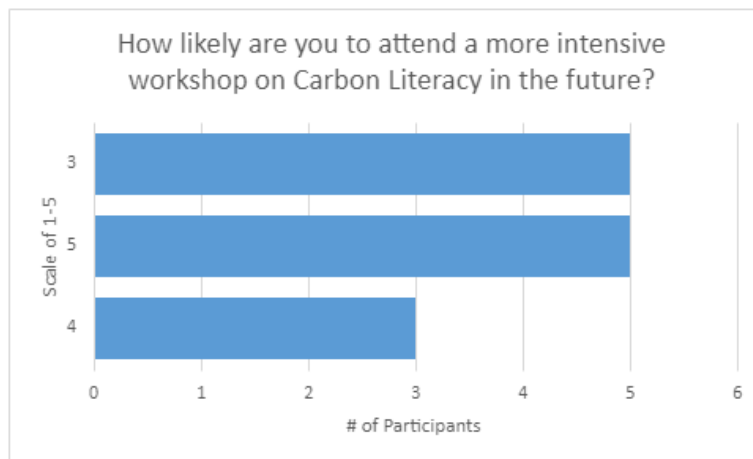


Figure 4: Results from prompt “How likely are you to attend a more intensive workshop on carbon literacy in the future?”

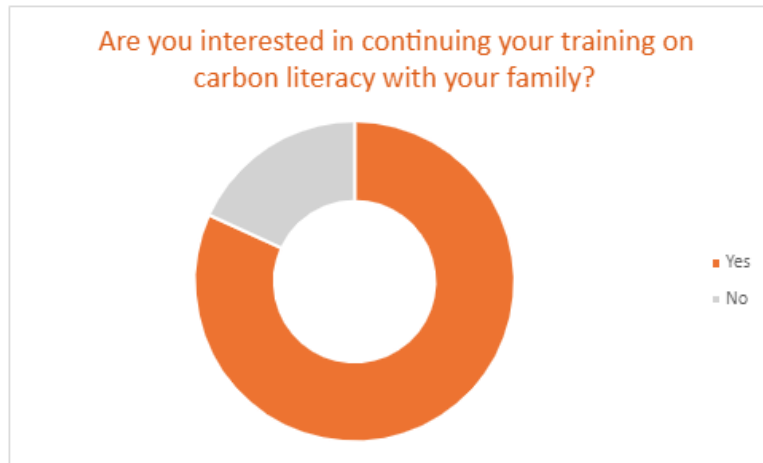


Figure 5: Results from prompt “Are you interested in continuing your training on carbon literacy with your family?”

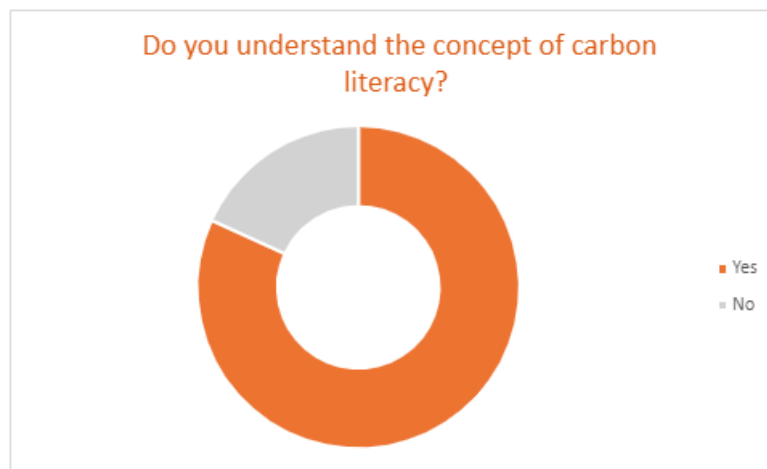


Figure 6: Results from prompt “Do you understand the concept of carbon literacy?”

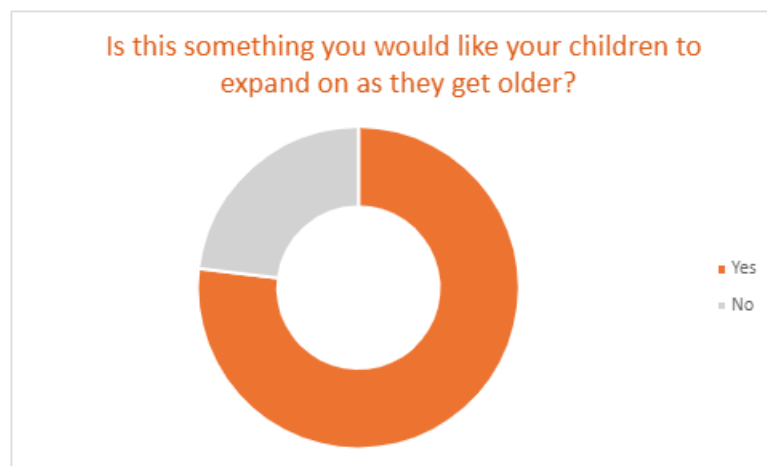


Figure 7: Results from prompt “Is this something you would like your children to expand on as they get older?”

As the results show, most responses we received agreed with the prompts. Most of the individuals also want to continue their knowledge on carbon literacy. The data shows that our workshop was effective at teaching individuals about carbon literacy and getting them to want to learn more about it.

Observational Data

We were also able to observe how the activities we provided affected the workshops. At the adult session we had a carbon footprint calculator, and a quiz, that we adapted from the taster session, with multiple choice questions.

During the use of the [carbon footprint calculator](#), the participants were eager and nervous to learn their score, but it encouraged conversation amongst participants. The participants then compared their results which started conversations on how to reduce their carbon impact. A few individuals found that their carbon footprints were less than UK's average which encouraged them to share the actions they are currently taking that lower their carbon emissions.

During the first two workshops, the quiz questions contained three obviously incorrect answer choices. This disengaged participants and made us change the questions after our second workshop. The new questions contained 4 correct answers, but we asked participants which choice reduced the most carbon emissions. Unfortunately, our first two workshops were the only ones with participants. Only having attendees at the first two workshops made it difficult to evaluate the workshop's impact.

At the family session we had a coloring activity, a story time and a planting activity. The coloring activity had some of the children disengaged from the workshop. The children did interact with the Greta Thunberg book we read because they had prior knowledge of Greta Thunberg. During the planting activities both the adults and children were engaged and excited to plant their herbs.

Taster Sessions

We delivered 6 taster sessions to the staff at several Worcestershire libraries. These taster sessions consisted of a slide show containing material from the carbon literacy project to entice participants to learn more about carbon literacy. The slideshow was adapted for both the University of Worcester and for library staff by Katy Boom, Sian Evans, and Gill Slater. We observed that the library staff attended the sessions in groups, each group from a different library. Surprisingly, the library staff did not have their own computers, which made it difficult to do some of the activities. This is a technological barrier that needs to be acknowledged when delivering future workshops. One of the participants reached out a few days later to learn more about taking the full 8-hour carbon literacy training.

5.0 Conclusions and Recommendations

This section starts with summary conclusions based on project results and findings. This section also presents recommendations for our sponsors and future related projects.

5.1 Summary Conclusions

Social media is the best marketing strategy

We discovered that social media was the most efficient way to reach our attendance. Utilizing the power of social media is an unrivaled marketing tactic for promoting carbon literacy.

People attend workshops if they are not during work and school hours

Our adult workshops ran from 1100 to 1200, on Tuesday, Wednesday, Thursday, Friday and Saturday. The only workshop to have outside participants was the one that ran on Saturday. Our family workshops were facilitated from 1530 to 1630 on Tuesday, Wednesday, Thursday and 1100 to 1200 on Saturdays. We had families with children, in our target age, show up to every family workshop we facilitated.

Attendees would like to continue their understanding on carbon literacy

When surveying the audience at the end of our workshops, 16 of the 19 individuals replied “yes” to the questions “Are you interested in continuing your training on carbon literacy?”.

Activity based workshops are more engaging

When analyzing participants during all aspects of the workshop, we found a higher level of engagement during the activities. We saw that children tended to disengage from the lecture portion and focus on coloring. Most discussion between participants came from activities such as the carbon footprint calculator, the story time we held during the family session, and the planting of an herb for the families to bring home.

5.2 Recommendations

R1: Student volunteers should deliver the workshops

To start, the library staff should continue developing their knowledge of carbon literacy by completing The Carbon Literacy Project training. Completing the training will ensure that the staff can be a knowledgeable resource to individuals attending the libraries that want to gain knowledge of carbon literacy.

The teacher’s guide (“Teachers Guide” file) developed as part of this project was initially intended for the library staff, but we realized this may not be realistic when considering the staff’s busy schedule. We recommend that students who attend the University of Worcester (UW) and are part of the University’s sustainability groups should

deliver these workshops. We recommend the University of Worcester promote this volunteer opportunity through their [Volunteer Opportunities website](#).

Finally, we recommend that the [Green Impact Project assistants](#), that attend the UW, deliver these workshops as they are already interested in the topic. These students should be trained to deliver the workshops and become certified through the Carbon Literacy Project. Additionally, students who earn the certification and make an impact on the community around them could find this project beneficial for their own personal development as individuals, which is a key aspect of carbon literacy.

R2: Incorporate Carbon Literacy sections in Worcestershire libraries

In view of the growing urgency to address climate change and promote sustainability, we recommend libraries across Worcestershire incorporate carbon literacy sections in their libraries. By providing a display case with books covering topics related to carbon literacy, such as sustainability, carbon emissions, and global warming, residents will grow to understand how to take practical action and reduce their carbon footprint.

Additionally, libraries could have interactive tables with resources to increase carbon awareness. We recommend these resources include engaging pamphlets, infographics, visuals, and reading material that introduce carbon literacy in libraries.

Students who work on this project in the future should create a carbon literacy pamphlet with the following key concepts in mind;

- Understanding your carbon footprint and how to reduce it.
- Adaptation and mitigation.
- Consequences of carbon emissions around the world.

The carbon literacy display case, table, and pamphlets ideally should be strategically placed throughout the library's most used and accessed areas, where it would be difficult for library visitors to miss. By implementing these recommendations, libraries can hold a pivotal role in promoting sustainability and increasing carbon literacy in Worcestershire.

R3: Market with incentives to attend

We recommend that for carbon literacy related events, the marketing should focus on providing incentives for the public to attend. Based on the low adult turnout at the workshops, we believe that the public needs more reason to attend a carbon literacy workshop. First, the marketing should mention that the workshop will provide climate co-benefits, which are additional beneficial outcomes from climate friendly actions that are not directly related to climate change mitigation. For example, the co-benefits of public/active transport would be the population becoming more fit and healthy from cycling and walking, along with the building, management, and planning of transportation networks creating jobs for a variety of skill sets (Carbon Literacy Taster, 2024). Another form of co-benefits would be climate friendly actions that can save money. Financial constraints are one of the reasons behind climate change inaction, and research found that 39% of lower income

individuals that did not make a sustainable purchase in March of 2023 cited cost as the main barrier (*For many, personal finances are an obstacle to choosing sustainability 2023*). The marketing should also mention that by taking the full CL training, individuals can receive a certification declaring them Carbon Literate. This certificate can be put on resumes and CVs, which provides another reason to be interested in a workshop about Carbon Literacy. It is important not to mislead attendees into believing they can receive the certification from attending the workshop.

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Appendix A Carbon Literacy Workshop – Consent Form

Informed Consent Agreement for Participation in a Research Study

Investigator: Kayla Afonseca, Tanishka Dalavi, Richard Osei, Angelo Rassias

Contact Information: gr-we24-hive@wpi.edu

Title of Research Study: Carbon Literacy Workshop

Sponsor: Dr Stephanie Jones, Ms. Katy Boom and Dr Sian Evans

We are a team of researchers from Worcester Polytechnic Institute in Massachusetts, USA. This survey is a part of a research project conducted by Kayla Afonseca, Tanishka Dalavi, Richard Osei, Angelo Rassias.

Purpose of the study: Today’s workshop will be about gaining awareness of the carbon cost and impacts of activities. The aim of these surveys will be to assess your understanding of Carbon Literacy before and after the workshop.

Procedures to be followed: The workshop will take no longer than one hour. Your participation within the workshop will be monitored to assess engagement. You are not required to participate in any aspect of the workshop. We will keep note of what participants choose to participate in.

Record keeping and confidentiality: We will be keeping the surveys in a OneDrive folder accessible by all the Investigator and Sponsors. The surveys will not note participants' names to keep the information confidential. We will only use the information provided to assess future workshops and the level of retention amongst all participants. Records of your participation in this study will be held confidential as far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

For more information about this research contact the email listed above. If you have any concerns or questions about your rights as a participant in this research, please contact the Worcester Polytechnic Institute Institutional Review Board’s Manager (Ruth McKeogh, Tel. 508 831-6699, Email: irb@wpi.edu) and the Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu).

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty. You may decide to stop participating in the research at any time without penalty. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

X _____

DATE: _____

Appendix B Adult Pre-Survey

This is a pre-survey for participants in the adult session to gauge their understanding of what Carbon Literacy is. This survey will also help us determine the effectiveness of our advertisements.

Participant Number: _____

What town are you from: _____

How often do you visit the library?

- _____ times a week
- _____ times a month
- _____ times a year
- This is my first time

What usually brings you to the library?

- Borrowing books
- Using the computers
- Special Events
- Other

Please state if other: _____

What advertisement brought you to attend this workshop?

- Library Television Advertisements
- Library Website Advertisements
- Library email/newsletter
- Heard from someone else
- Other

Please state if other: _____

What attracted you to this workshop?

- Understand what the workshop is about
- Learn about Carbon Literacy
- Gain resources to reduce your Carbon Footprint
- Other

Please state if other: _____

Have you heard of the term Carbon Literacy before?

If you have heard of the term, explain Carbon Literacy in your own words?

I know that United Kingdom is trying to hit net zero carbon emission by 2050

- YES
- NO

The following questions are going to be asking you to rate how well you relate to the statement on a scale of 1 to 5.

I could describe carbon emissions to someone else.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I am concerned about global climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Individuals have the power to make a positive impact on climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Corporations have more power than I to reduce the overall carbon emissions.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I recycle to reduce my carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I wish I did more to reduce my carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Appendix C Family Pre-Survey

This is a pre-survey for participants in the family session to gauge their understanding of what Carbon Literacy is. This survey will also help us determine the effectiveness of our advertisements.

Participant Number: _____

What town you are from: _____

How often do you visit the library?

- _____ times a week
- _____ times a month
- _____ times a year
- This is my first time

What usually brings you to the library?

- Borrowing books
- Using the computers
- Special Events
- Other

Please state if other: _____

What advertisement brought you to attend this workshop?

- Library Television Advertisements
- Library Website Advertisements
- Library email/newsletter
- Heard from someone else
- Other

Please state if other: _____

What attracted you to this workshop?

- Learning about Carbon Literacy
- Event to attend with my family
- Gaining resources to reduce your Carbon Footprint
- Other

Please state if other: _____

Have you heard of the term Carbon Literacy before?

If you have learned the term, what do you think Carbon Literacy is about?

What are your current family practices to reduce your carbon footprint?

I know that United Kingdom is trying to hit net zero carbon emission by 2050

- YES
- NO

The following questions are going to be asking you to rate how well you relate to the statement on a scale of 1 to 5.

I could describe carbon emissions to someone else.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I am concerned about global climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Individuals have the power to make a positive impact on climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Corporations have more power than I to reduce the overall carbon emissions.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

We recycle to reduce our carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

We wish we did more to reduce our carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Appendix D Adult Post-Survey

This is a post-survey for participants in the adult session to gauge if they learned more information on Carbon Literacy. This survey will also help us determine the effectiveness of our workshop.

Participant Number: _____

What town are you from: _____

How likely are you to attend a similar workshop in the future?

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Are you interested in continuing your training on carbon literacy? (Yes/No)

Do you understand the concept of carbon literacy? (Yes/No)

I know that United Kingdom is trying to hit net zero carbon emission by 2050

- YES
- NO

The following questions are going to be asking you to rate how well you relate to the statement on a scale of 1 to 5.

I could describe carbon emissions to someone else.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I am more concerned about global climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Individuals have the power to make a positive impact on climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Corporations have more power than I to reduce the overall carbon emissions.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I will recycle to reduce my carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I wish I did more to reduce my carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Appendix E Family Post-Survey

This is a post-survey for participants in the family session to gauge how much they learned about Carbon Literacy is. This survey will also help us determine the effectiveness of our workshop.

Participant Number: _____

What town are you from: _____

How likely are you to attend a similar workshop with your children in the future?

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

How likely are you to attend a more intensive workshop on Carbon Literacy in the future?

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Are you interested in continuing your training on carbon literacy with your family? (Yes/No)

Do you understand the concept of carbon literacy? (Yes/No)

Is this something you would like your children to expand on as they get older? (Yes/No)

I know that United Kingdom is trying to hit net zero carbon emission by 2050

- YES
- NO

The following questions are going to be asking you to rate how well you relate to the statement on a scale of 1 to 5.

I could describe carbon emissions to someone else.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

I am more concerned about global climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Individuals have the power to make a positive impact on climate change.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Corporations have more power than I to reduce the overall carbon emissions.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

We plan to recycle to reduce our carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

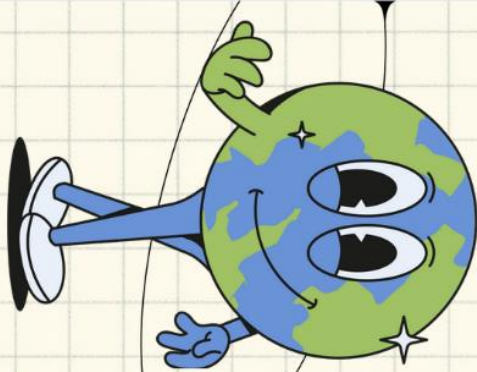
I wish my family did more to reduce our carbon footprint.

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

THE HIVE TEAM PRESENTS

A FAMILY ADVENTURE EcoPALS

FREE ENTRY



22 MAR
Evesham
3:30 PM

23 MAR
Malvern
11:00 AM

26 MAR
Redditch
3:30 PM

28 MAR
Bromsgrove
3:30 PM

04 APR
Kidderminster
3:30 PM

13 APR
The Hive
11:00 AM

ACTIVITIES

- ◆ SNACKS INCLUDED
- ◆ FUN FAMILY PLANTING
- ◆ COME COLOUR WITH US
- ◆ STORY TIME SESSION!

Spark your family's passion for the environment! Join our carbon literacy workshop made specifically for families and kids.

For more information visit:
www.worcestershire.gov.uk/libraries

Worcestershire
county council

What is Carbon Literacy X

An Interactive Workshop
Made for those who are eager to live a more Net Zero lifestyle. Learn simple ways to make a difference in your daily life. Join us at your local library. Sign up today! Limited Seats Available!

Free Entry

LOCATIONS & TIMES

 Evesham Friday 22/03 11AM	 Malvern Saturday 23/03 2PM
 Redditch Tuesday 26/03 11AM	 Bromsgrove Thursday 28/03 11AM
 Kidderminster Wednesday 03/04 11AM	 Hive Saturday 13/04 2PM

Tea
Provided

For more information visit:
www.worcestershire.gov.uk/libraries

Worcestershire
county council