Building Carbon Literacy:
Results from an International Survey

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Funding: RSE number: Awardee ID 1100

Acknowledgements
This project was generously supported by COP 26 International Networking Grant from the Royal Society of Edinburgh. Sincerely thanks to CSEAR members, CRBF and other colleagues for the generous input and support during workshops and in connection with the survey.

20 December 2021

EXECUTIVE SUMMARY

Climate change is now the largest threat to all life on Planet Earth. Amidst this crisis, decision makers are required to know how today's decisions are connected to past, present and future greenhouse gas (GHG) emissions. Ways of thinking, valuing consequences and making decisions are not attuned to efforts to reduce carbon dioxide or other GHGs. GHG awareness or carbon literacy is not yet embedded in ways of learning, working and living. Knowledge, competencies and experience are required alongside practices and technologies to sense, measure and account for GHG consequences, in order to correct and complement existing accounting systems.

All disciplines and professions must recognise and enhance their carbon literacy if they are to contribute to the reduction of atmospheric concentrations of GHG to manageable levels. Ignorance of GHG consequences, or naively trusting others to provide that evidence, has resulted in many decision makers genuinely believing their actions will reduce GHG when, instead, they might actually lead to an increase of global GHG. Not properly accounting for GHG, or getting GHG measurements wrong, means that an array of critical decisions are based on misinformation. Existing research demonstrates how flawed and inaccurate most forms of GHG accounting can be[1].

2017; Comyns and Figge, 2015; Collison et al. (2014); Comyns, 2018; Ferguson et al. (2011); Haslam et al., 2014, 2018; Kolk et al., 2008; Liesen et al., 2015; Lovell and Mackenzie, 2011; Sales de Aguiar and Bebbington, 2014; Thomson et al, 2021.

Education is central to ensure that the accounting and finance professions transition away from being a contributing factor to our climate emergency. Academics, students, professional bodies, higher education institutions and employers can strengthen existing connections to transform educational programmes and qualifications. To do so requires better understanding of where and how climate change and sustainability are considered. This evidence, alongside insights into educators' experiences, can lead to the identification of pathways to integrate climate change and sustainability, as systemic concerns, into educational programmes. By supporting students as citizens and future accounting and finance professionals to develop literacy, competencies and knowledge, academics will further contribute to global coalitions to realise aspirations for sustainable climate governance and stewardship.

Building on long-term interest in social and environmental accounting education[2] and supported by the Royal Society of Edinburgh (RSE), this project launched a multi-language global survey designed to:

- map the provision of climate change education in accounting and finance education across the world;
- understand the dissemination of carbon literacy in accounting and finance programmes;
- understand barriers and facilitators to teaching climate change;
- build a supportive network and co-create resources to enable educators to mainstream climate change and sustainability in accounting and finance education.

RESULTS

- 124 out of 154 respondents reported teaching climate change in accounting and finance at Higher Education Institutions in 31 different countries across Europe, South America, North America, Africa and Asia.
- Most respondents appeared to adopt a *piggy-backing* strategy of adding climate change into existing modules.
- Climate change was not fully integrated across all accounting and finance programmes. Instead, climate change and sustainability were often concentrated in specialist – and often optional - social and environmental accounting modules.
- Committed and networked individuals appear to develop and deliver climate change and sustainability teaching often without connection to wider institutional strategies, programmes or in response to accreditation requirements.

[2] CSEAR members are committed to enhancing education connected to sustainability, social and environmental accounting through teaching case competitions (Grubnic et al 2015; Garcia and Thomson, 2018), academic research (see for example: Lewis et al, 1992; Owen et al. 1994; Thomson & Coulson 2006, Stevenson & Thomson 2010; Dyball & Thomson 2013; Gray, 2013; Kamp-Roelands, 2013; McPhail, 2013; Schaltegger 2013) and publication of teaching texts (see for example, Laine, Tregidga & Unerman 2021).

- Membership of academic networks and other communities of practice was associated with higher reported levels of including climate change in their accounting and finance teaching.
- Professional accreditation or professional practise was neither a driver nor an obstacle to efforts to teach climate change and/or sustainability. Nevertheless, accreditation and professional practice were identified as having the potential to drive further change building on the work of these early innovators.
- Sharing experiences, positive and negative, and enabling climate knowledge exchange was identified as critical for mainstreaming this topic.

SUGGESTED ACTIONS

Climate change requires involvement of many stakeholders, including but not limited to academics, students, professional bodies, and higher education institutions. To further embed climate into accounting and finance education, the following actions were identified as having the potential to further mainstream climate change education and associated topics, in order to make climate change a normal part of accounting and finance education and to ensure all accounting and finance institutions are aligned with efforts to tackle climate change:

- Deeper appreciation and effective communication of the relevance of climate change to accounting and finance
- Greater consideration of climate change issues in academic research, accounting associations and professional journals through special issues and associated conferences and workshops
- Promoting an interest in, and concern with, climate change by accounting and finance practitioners and professional bodies
- Inclusion of climate change in university strategies, vision statements and educational programme outcomes
- Dialogue with students to establish their demand for coverage of issues they see as very relevant to their day-to-day lives and future professional life
- Increasing the number of active researchers in the area of climate change
- Effective communication of professional bodies' recognition that climate change is a legitimate part of accounting and finance curricula
- The development of a community of practice for an authoritative source of expertise on climate change accounting and finance to enhance academics' capacity to teach climate change and sustainability.
- The inclusion of climate change accounting and/or finance as an accreditation requirement by professional accounting bodies
- Development of standardised teaching resources (e.g. textbooks or case studies) accompanied by a portfolio of customisable teaching resources

We are aware that mainstreaming climate change in accounting and finance will involve a substantial collaborative effort. Individuals, networks and institutions could co-operate to co-

produce programmes, modules, new pedagogic methods, teaching materials, texts, cases, assessments to name but a few.

Any contribution, no matter how insignificant you think it is, will make things better. We need your support. We cannot do this on our own. But together we could make a difference. If you are interested in being part of this movement, or would like us to join in your movement, please get in touch. We look forward to hearing from you.

To contact us, please email Centre for Social and Environmental Accounting <csear@st-andrews.ac.uk> using Building Climate Literacy in the subject line.

Join conversations on CSEAR Facebook Group (https://www.facebook.com/groups/121691174537092/) and following CSEAR on Twitter https://twitter.com/csearUK?s=20) or LinkedIn (www.linkedin.com/in/csear-uk-st-andrews-b5b95115b).

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Abbreviations and Acronyms

CCE	Climate Change Education
GHG	Greenhouse gases
HEI	Higher Education Institution
PRME	Principles for Responsible Management Education

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BUILDING CARBON LITERACY

INTRODUCTION

Accounting and finance are central to addressing the climate emergency and reaching a net-zero carbon future. These professions are tasked with the summary, analysis and reporting of financial data which inform critical decisions on which climate change in public, private and community-based organizational settings. Accounting and finance matter. No matter how effective new products, technologies or provisions are for reducing greenhouse gas (GHG) emissions, innovations may be rejected because existing accounting tools cannot or do not correctly assess the costs and benefits of climate impacts in a way that enables access to funds to finance their implementation. Although accountants and finance professionals are central to the way that organizations across the globe respond and adapt to climate change, we know little about the knowledge, skills and capabilities of these professionals in this context.

Future accounting and finance professionals will likely study at and engage in activities in higher educational institutions, particularly those associated with the department, school or faculty in which they are based as well as student-led societies and campaigns. These students' awareness of climate change or sustainability-related education or initiatives[3] may vary depending on levels of interest, publicity and the degree to which such topics are considered in their education. Within these contexts, educators may be working hard to integrate climate change into accounting and finance education or wish to do so but face various challenges. In order to better understand patterns of climate change education delivery and experiences of doing so, a multi-language online survey was created and academics from accounting and finance were invited to participate. This report presents findings from this online survey undertaken from June to September 2021[4] as part of the 'Building Carbon Literacy' Project that aims to

- map the provision of climate change education in accounting and finance education across the world;
- understand the dissemination of carbon literacy in accounting and finance programmes;
- understand barriers and facilitators to teaching climate change;
- build a supportive network and co-create resources to enable educators to mainstream climate change and sustainability in accounting and finance education.

The report is structured as follows: first, literature pertaining to climate change education is reviewed to provide a background in which to situate the presentation of results in the second section. The third and final section concludes the report with recommendations and areas for future research.

[3] For example, a School's commitment to voluntary initiatives such as the United Nations Principles for Responsible Management Education or a University's commitment to the UN SDG Accord.

[4] See Appendix 1 for a description of the methodology used to develop the survey and analyse results.

LITERATURE REVIEW

Climate change and wider concerns with sustainability are of increasing interest to a number of disciplines. Literature in environmental education, management education and accounting education was reviewed alongside recent policy reports concerning the contribution of higher education to climate change and sustainable development to develop the survey. Here, we outline key themes arising as a backdrop against which to consider the survey findings.

Climate change education (CCE) & Higher Education

Climate change education (CCE) spans education, training, public awareness, public participation, public access to information and international cooperation (UNFCCC 2015). Mitigation-related education could include identifying the causes of climate change and developing the knowledge, skills, and dispositions required for individual and collective action to resolve the causes of climate change; while adaptation could include developing knowledge and skills to cope with existing and expected climate impacts. Such efforts extend beyond technical concerns, to include cultural, political, socio-economic and power-laden relationships that influence the unequal responses to and impacts of climate change in the Anthropocene (Leichenko and O'Brien, 2020). Finally, CCE spans educational programmes and other institutional initiatives that aim to enhance the preparedness and responsiveness to climate change challenges (Mochizuki and Bryan 2015, Thew et al 2021).

Higher education institutions (HEIs) play a central role in enhancing CCE under Article 12 of the Paris Agreement (UNFCCC, 2015). HEIs can address climate change across governance, education, campus operations, research and community outreach (Henderson et al 2017). Recently, academics have called for climate change education to align with learning provision, teaching capacity and graduate attributes through efforts to mainstream climate change education (Thew et al 2021). Mainstreaming (where climate change is included but spread across the entire curriculum) is just one approach to CCE. Others include *piggy backing* (adding climate change education to individual courses); *connecting* (integration of climate change education across all university courses))[5]; or *specialising* (the creation of specialised courses such as Masters programmes in Climate Change Finance). Despite growing evidence of climate change being covered in higher education degrees, further work is required to understand regional and geographical patterns of delivery and how different disciplines incorporate climate change into teaching and learning (Molthan-Hill et al , 2019).

Various initiatives for Higher Education Institutions and associated stakeholders to support climate action, including that related to education have already been implemented (see Appendix 2). In the field of business and management, the United Nations Principles for Responsible Management Education (PRME) and the PRME Working Group on Climate Change

[5] For example, *Vertically Integrated Projects* that bring students across all year groups and disciplines to work on a research project with academics in line with the UN SDG Agenda (see Strachan et al 2019).

and the Environment have been recognised as important initiatives shaping the values, research and education across business and management schools around the world. Despite the growth in initiatives, further investigation is required into the ways in which accounting and finance academics, students, funding bodies, professional bodies and associated stakeholders have, or could engage, with these national, regional and international initiatives.[6]

Literacy, competencies and pedagogical approaches

CCE is associated with the enhancement of carbon or climate literacy (Howell 2018, Molthan-Hill et al 2020a) and wider knowledge, competencies, attitudes, values and behaviours (Thew et al 2021). Carbon literacy is "an awareness of the carbon dioxide costs and impacts of everyday activities and the ability and motivation to reduce emissions on an individual, community and organizational basis." (Carbon Literacy Project) and in accordance with the Carbon Literacy Standard (2016, p. 1)[7]. Climate literacy refers to the understanding that "life is shaped by climate and the role earth's systems play, having the skills to communicate climate change science in a manner that is locally relevant and being aware of ways to address the social and physical ramifications of a warming climate" (Cooper et al 2019). Alongside literacy, competencies for sustainability are likely to be integral to climate change education (Thew et al 2021). Wiek et al (2011) defined competencies as "a functionally linked complex of knowledge, skills and attitudes that enable successful task performance and problem solving" and identified the following competencies to assess education for sustainable development: strategic, normative, anticipatory, systemic working and interpersonal.

Pedagogical approaches that can best support effective CCE emphasise student-centred learning where meaningful and gives students opportunities to develop experiential knowledge as change agents with a strong sense of agency and personal responsibility and connection with issues and understand their role in addressing climate change (Munroe et al 2019, Thew et al 2021). Approaches to CCE could include deliberative discussion amongst students and educators to better understand viewpoints and knowledge on climate change; opportunities to interact with scientists and understand scientific process; exercises to understand the complexity and systemic nature of current and future concerns; and design and implement projects to address climate change (Munroe et al 2019). Further understanding of the literacy, competencies and pedagogical approaches used in accounting and finance education is required with opportunities to share learning and resources. In order to better understand

[6] A desk-based review of PRME Reports has been conducted as part of the project. Researchers noted an absence of climate change as an important topic for responsible management education and an absence of climate-related accounting and finance education.

[7] The Carbon Literacy Project was developed by Cooler Project CIC and was recognised as a globally unique example of a Transformative Action Program at the Paris Climate Summit in 2015. Training has been developed for industries including the television sector (see Chapple et al 2020) and for management and business schools (see PRME Working Group on Climate Change and Environment (see https://www.unprmeclimate.org/events-1 for further information)

competencies, we now turn to review literature concerning the factors that could shape efforts for CCE in higher education contexts.

Factors shaping climate change education

As stakeholders, such as students and policy makers demand societally relevant education (Facer 2020 Thew et al 2021), staff and institutions may face challenges around climate change education as an underdeveloped field (Molthan-Hill et al, 2019). Challenges could include conception of the issue, complexity and scale, lack of training and professional development of educators, limited resources, curriculum constraints, competing themes, limited institutional support or scepticism and controversy (Hess and Collins 2018, Hulme 2009, Leal-Filho & Hemstock 2019, Leichenko & O'Brien 2019). Importantly, Petersen and Barnes (2020) note a key barrier to climate change education is the lack of hope and agency that people feel in confronting climate change impacts, pointing to the emotional dimensions of climate change. Other barriers may relate to the relative prominence of climate change in a particular discipline and coverage of the topic in academic outlets (Hindley and Wall (2017)[8] and perceived lack of engagement by professional bodies (Owen, 2013; Kamp-Roelands, 2013). At an institutional level, the need for interdisciplinary working may challenge departmental organisation and require individuals to dedicate time and resources to create collaborative relationships which may in turn be in tension with measures of success and performance firmly embedded in educational institutions (O'Brien et al., 2013a; O'Brien et al., 2013b; Simon and Schmiemer, 2015). Finally, further barriers are identified in relation to sustainable development (McCowan, 2019) more generally and higher education, but which are relevant for climate change education, such as the commodification of education and status competition (where universities compete for status, leading to particular focus on elite education and research journals). So, while universities are required to educate future generations to respond to climate change, and there are calls to train people so that with the complex issues and challenges posed by climate change, educational delivery systems face significant barriers.

Climate change and accounting and finance education

As momentum builds to address climate change, accounting and finance are increasingly found to be linked to the production and consumption of greenhouse gas emissions, the creation and operation of instruments to manage and mitigate emissions, and the assessment of and investment in infrastructure to adapt to climate change (Thomson et al 2021). Often denoted by the short-hand 'carbon' rather than climate change, accounting concerns span technical aspects of calculating carbon or GHG equivalents and associated reporting to internal and external audiences (Molthan-Hill et al 2020a), the consideration of climate risk in financial markets (Bebbington et al 2020) as well as natural science and social science research (Charnock, et al 2021). Within this dynamic and evolving domain, many resources spanning

[8] Hindley and Wall (2017) found only five full-text five articles included the terms climate literacy, climate change education or curriculum or climate change, demonstrating the insufficient consideration of the issue in the field.

carbon accounting, climate risks and assurance are available to inform teaching and learning (see Appendix 4).

Despite growing interest in climate change, carbon and greenhouse gas emissions in research, less is known about where and how climate change is taught in accounting and finance education and management education more generally (Molthan-Hill et al 2020a). By conducting the survey of current patterns of CCE in accounting and finance as well as exploring experiences and challenges faced by educators, this survey responds to calls to enhance ecological literacy of accountants to contribute to collective efforts to address the climate emergency (Bebbington et al 2021)

Summary

This project focuses on accounting and finance education delivered within higher education contexts spanning institutional initiatives aimed at enhancing the extent education systems are prepared for and responsive to climate change challenges. Literature reviewed suggests that while work is underway to develop carbon literacy and evaluate climate change education, further efforts are required to mainstream climate change education across higher education degrees and to understand where and how climate change is covered in accounting and finance.

The next section presents an overview of survey results in order to understand patterns of climate change education, explore experiences of teaching climate change and views on carbon literacy and the competencies.

SURVEY RESULTS

The results are presented and discussed with reference to the following questions:

- Who responded?
- What are respondents' institutions doing with regards climate change?
- What drives respondents' efforts to engage in climate change education?
- What climate change topics are taught, in which subjects and what competencies are developed?
- How is climate change accounting and finance education delivered?
- What challenges arise in connection with teaching climate change and/or sustainability?
- What should students learn in connection to climate change?

Who responded?

There was an encouragingly high number of responses representing a large number of countries, institutions and covering different demographics. While this survey cannot be assumed to fully represent the global accounting and finance education provision, it does include sufficient diversity to draw some initial insights in line with the objectives of the survey as well as identify critical areas for further research.

- 154 people completed the survey and 31 countries were represented[9]. The five top national responses were from U.K, Brazil, France, Italy and China.
- 97% agreed that climate issues should form part of accounting and finance education.
- 88% of respondents worked in departments within higher educational institutions, 8% in stand-alone Business Schools and the remainder worked as professional/vocational trainers or consultants
- 81% of respondents (located in 26 countries) covered climate change in their teaching
- 80% of the respondents self-identified as part of the discipline of Accounting, 7% Finance and 5% Management. However, the distinction between Accounting and Finance is not always consistent across different institutions and different countries.
- 61% have published research on this topic, with an additional 16% working on related research[10].
- 59% of respondents had been a CSEAR member in the last 5 years.
- 37% had been a member of a professional accounting or finance institution in the last 5 years.
- 30% of the respondents work in the Global South with a similar percentage located in middle income countries. The majority of the respondents were from the Global North and High Income Countries.

[9] See Figure 3 in Appendix 3 for full details of countries in which respondents' institutions are based

[10] See Figure 4 for full breakdown of responses

- 22% of respondents were not involved in CSEAR or any other academic community. Many respondents were members of national accounting associations.
- 17% of respondents worked in institutions where their programmes were not accredited in some way by external institutions.

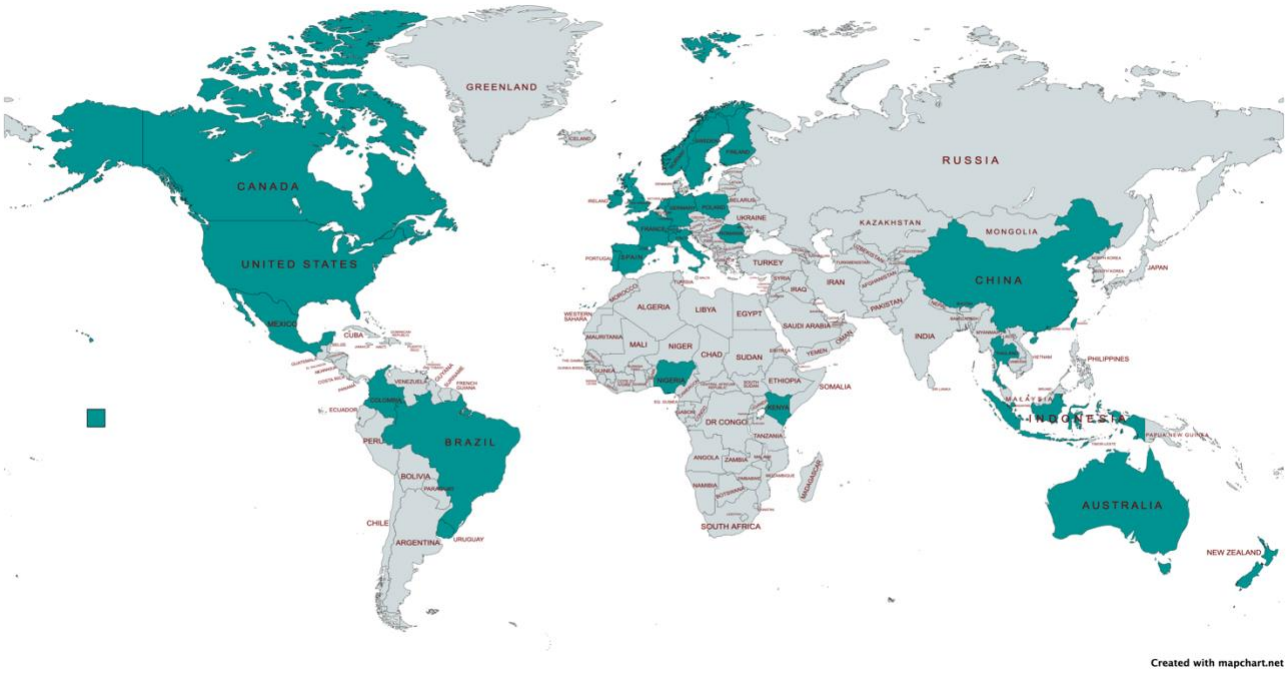

FIGURE 1: MAP OF LOCATION OF RESPONDENTS' INSTITUTIONS[11].

What are respondents' institutions doing with regards climate change?

Respondents were asked to share information about institutional initiatives related to climate change in order to understand the contexts in which accounting and finance education is undertaken (see Table 2 below). Most institutions had research expertise in climate change and/or sustainability (78%) and were addressing climate change/sustainability through campus operations (70%). Around half of respondents' institutions were holding high profile events (54%), informing stakeholders about relevant accomplishments (52%) and engaging with communities (50%). In terms of accounting or finance related initiatives in higher educational institutions, including being a signatory to the United Nations Sustainable Development Goals (37%), only 32% of institutions were reporting emissions, 20% committed to divesting from non-renewable resources and only 10% of respondents indicated that their institution had declared a climate emergency.

[11] Map created with https://mapchart.net/

TABLE 1: MAPPING CLIMATE CHANGE ACTIVITIES ACROSS HIGHER EDUCATION INSTITUTIONS[12]

Governance & Operations	Reporting & Stakeholder engagement	Education & Research
		Research expertise in climate change/sustainability **78%**
Address climate change /sustainability through campus operations **70%**		
Climate change /sustainability included in governance **60%**		
	High profile events on climate change/sustainability **54%**	
	Informs stakeholders about relevant accomplishments **52%**	
	Climate change/sustainability Community outreach **50%**	
	Student societies leading climate change campaigns **38%**	
UN SDG signatory **37%**		
		Committees to support delivery of climate change/sustainability in teaching **34%**
	Institutional prizes in climate change/sustainability **33%**	
	Reports carbon emissions **32%**	
Climate change committee, coordinator or champion **31%**		
		Cross-faculty modules on climate change/sustainability **30%**
Committed to divesting from non-renewable resources **20%**		
Declared a climate emergency **10%**		
Is carbon neutral **6%**		

While there have been calls for Higher Education Institutions to do more in order to mainstream climate change education and other action through operations, results suggest that much remains to be done and there may be opportunities for accounting and finance

[12] Henderson et al 2017's analysis of Canadian HEIs institutional response was conducted with reference to the following categories: governance (institutional priorities, values, strategic priorities); education (e.g., curriculum, pedagogy) campus operations (e.g., reducing emissions from campus buildings, transport) and community outreach (e.g., with students, staff and off-campus communities). Here we've used the terms 'reporting and stakeholder engagement' to denote areas that may be of particular interest for accounting and accountability educators.

academics to contribute to such efforts. In the meantime, respondents' answers provide some insight into the context in which their efforts and experiences of teaching climate change take place. Now, we turn to an exploration of drivers of climate change education.

What drives respondents' efforts to engage in climate change education?

The responses appeared to indicate a personal drive to integrate climate change into their teaching but this was also associated with high levels of public discourse.

- 97% of respondents indicated a personal commitment to matters relating to climate change.
- 97% agreed that educational institutions should educate students about issues related to climate change.
- 96% agreed that the consequences of climate change will be very serious.
- 84% agreed that climate change was discussed in public in the country where they worked[13]

The evidence was significantly lower for external drivers of change, such as climate research in accounting, government, civil society, private sector actions, student demand or professional accreditations.

- 67% noted the increasing importance of climate change and/or sustainability within both national and international political agendas but only 42% agreed that government was driving climate change responses in the countries where they work.
- 67% stated that they teach sustainability and climate change because of their personal involvement or commitment to activism
- 62% agreed with the statement "Civil society is mobilizing to campaign for climate action in the country where I work" this can be compared with the lower figure of 41% who agreed that "The private sector is leading responses to climate change in the country where I work.
- 47% were influenced by a greater consideration of climate change and/or sustainability issues in academic and professional journals
- 47% were influenced by a growing interest in, and concern with, climate change and/or sustainability by practicing accountants and professional bodies but only 30% agreed that professional bodies recognised that climate change and/or sustainability issues were relevant to accounting curriculum
- 32% were influenced by the inclusion of climate change in their organisation's strategies, programme outcomes or vision
- 31% referenced a growing demand by students for coverage of issues they see as very relevant to their day-to-day lives
- 20% noted the existence of a climate change community of practice or authoritative source of expertise as facilitating their efforts to teach climate change or sustainability
- Only 19% agreed with the suggestion that they taught climate change because of accreditation requirements.

[13] Open text responses noted that personal concern and/or increased media coverage of extreme weather events and associated impacts was also motivating efforts to incorporate climate change into their teaching.

- 8% were influenced by the availability of standardised or customisable teaching resources (e.g. textbooks, protocols or case studies)

What climate change topics are taught, in which subjects and what competencies are developed?

Climate change featured primarily across undergraduate, postgraduate and, to a lesser extent, doctoral programmes.[14] Some respondents noted that the topics were also covered in professional qualifications or continuing professional development. Responses indicated that, on average, climate change was taught across 2.5 modules in their institution, ranging from none to 12 modules. That climate change education was included in a range of different accounting / finance subjects perhaps indicates the systemic way in which climate change intersects with large parts of accounting and finance.

However, when compared with other disciplinary efforts to integrate climate change into curricula, climate change in accounting and finance education is almost invisible in the literature (Molthan-Hill 2020a, Leal Filho et al 2018). Responses indicated that climate change tended to be included on courses on Sustainability Accounting and Corporate Social Responsibility (CSR) – although responses also suggest that climate change features in a number of other subjects, including Management Accounting and Financial Accounting. However, there was less evidence of climate change featuring in Finance-related courses. Table 3 outlines the frequency of where climate change was delivered in accounting and finance subjects. This pattern of responses indicates a lack of mainstreaming of climate change into accounting and finance, despite the way in which climate change is impacting on policies and professional practice in these areas, for example 13 professional accountancy bodies have made a net zero pledge[15]. Only 35% of respondents noted that climate change was integrated into multiple or all subjects in a programme, and a similar % noted it was either offered or in the process of being offered as an elective module. 13% of respondents noted this topic was offered in a separate compulsory module. This suggests a number of gaps in educational provision that need to be filled, especially if Sustainable Accounting and/or CSR are optional modules. For example, this evidence suggests that if a student doesn't choose a Sustainable Accounting or CSR subject, then only 26% of students will be exposed to Climate Change disclosure requirements in their Financial Accounting /Reporting subjects.

TABLE 2: COURSES THAT INCLUDE CLIMATE CHANGE AND/OR SUSTAINABILITY

[14] See Appendix 3, Figure 5 for full breakdown

[15] https://www.icaew.com/insights/viewpoints-on-the-news/2021/Nov-2021/ICAEW-joins-global-accountancy-drive-to-achieve-net-zero

over 40% of cases	39-20% of cases	19-10% of cases	< 10% of cases
Sustainable Accounting **57%** Corporate Social Reporting **46%**	Management Accounting **28%** Financial Accounting **26%**	Corporate Governance **17%** Research Methods **15%** Contemporary Issues **15%** Risk **12%** Accounting Theory **11%** Financial Reporting **10%**	Other **8%** Audit **5%** Corporate Finance **5%** Valuation **4%** Capital Markets **3%**

Respondents provided more granular detail about their teaching with regards to competencies[16] developed and topics covered (see Table 3). Many indicated that students developed competencies with regard to their own role and responsibilities (88%) and those of professionals (84%) as well as impacts (85%) and drivers (70%) of climate change . Less emphasis was placed on developing competencies around the norms, practices and opinions associated with climate change (46%) or dealing with uncertainty (43%). With regard to specific topics, results suggest that disclosures and integrated reporting were covered, while less than half include carbon accounting or footprinting and only 13% cover product or service level considerations. Climate change was often connected to related topics such as the United Nations Sustainable Development Goals (63%), planetary boundaries (38%), biodiversity and ecosystem services (36%). Fewer respondents covered poverty, land use or decolonisation. Further work is required to understand how topics are taught and integrated into individual modules or programmes in order to extend and enhance students' competencies in contributing to wider sectoral, or societal sustainable climate change initiatives.

[16] Wiek et al (2011) defined competence as "a functionally linked complex of knowledge, skills and attitudes that enable successful task performance and problem solving" and identified the following competencies to assess education for sustainable development: strategic, normative, anticipatory, systemic working and interpersonal.

TABLE 3 COMPETENCIES & TOPICS IN RESPONDENTS' TEACHING COVERED

	over 80% of cases	79-60% of cases	59-40% of cases	39-20% of cases	< 20% of cases
Competencies	Individual role & responsibilities for climate change **88%** Impacts of climate change **85%** Professional Responsibilities **84%**	Drivers of climate change **70%**	the importance of norms, practices & opinions **46%** dealing with risks, change & uncertainty 43%	how to assess the consequences of actions on climate change **39%** understanding complex systems & links to climate change **35%** applying different strategies to address climate change **23%**	designing viable inclusive solutions to climate change **15%**
Topics		Disclosures and integrated reporting 69% Impact on Business 68% SDGs 63%	Carbon Accounting and Foot Printing 49% Climate Governance 44%, Business Models 42%	Planetary boundaries **38%** Biodiversity & ecosystem services **36%** Social Change & Justice **32%** Inequalities **31%** Climate justice **31%** Climate change adaptation **30**% Climate Change Mitigation 28% Consumption 27% Critical studies, Human Rights 26% Valuation, Waste 25% Policies, Water 23% Energy, Risk 22%	Poverty **16%** Product and services **13%** Land Use **10%** Decolonisation **8%**

How is climate change accounting and finance education delivered?

The mode of delivery appeared typical of how mainstream accounting and finance material is delivered to students, with lectures, case studies and workshops the most commonly used teaching approaches for the delivery of climate change education. There were a number of interesting educational practices identified in the survey responses that are worthy of further investigation with regard to their effectiveness or power to engage students. These included applied learning, collaboration with other academics, climate scientists and other disciplines, alongside other practices such as simulations, scenarios, problem-based learning, fieldtrips and practice engagement (including activist groups). Open text responses provided insights into the development of curriculum with reference to weak-strong sustainability which enabled efforts to link accounting to other disciplines with the "ethic of good living (buen vivir)"; the hosting of specific courses in forest or outdoors environments; launching topic-specific doctoral programmes and advanced degrees. Interestingly, 74% of those who taught climate change stated that climate change did appear in student assessment. Inclusion in student assessment is often a strong legitimating signal of the importance placed in a topic by an individual lecturer to their students (Thomson & Coulson 2006).

TABLE 4 TEACHING APPROACHES USED IN CONNECTION WITH CLIMATE CHANGE AND/OR SUSTAINABILITY

Most Common Methods	Frequent Methods	Less frequent innovations
Lectures **81%**	Problem-based learning **25%**	Applied learning **12%**
Case studies **71%**	Collaboration with other academics, different disciplines or climate science **25%**	Field visits **8%**
Workshops **52%**	Scenarios **17%**	Simulations **6%**
		Practice engagement (including activists) **5%**
		Cultural activities or arts **3%**
		Laboratories **3%**

In terms of teaching materials, teachers tended to use climate disclosures and sustainability reports as well as disclosure initiatives and scientific reports. Court rulings and activist reports were the most infrequently cited teaching resources. However, each respondent reported using an average of almost 5 different resources in their teaching.

TABLE 5 RESOURCES USED IN TEACHING CLIMATE CHANGE AND/OR SUSTAINABILITY

Most Common Resources	Frequently used resources	Less frequent resources
Climate disclosures and sustainability reports **81%** Disclosure initiatives **69%** Scientific Report **63%**	Social media and newspapers **49%** Press release **45%** Policy and professional documents **44%** Documentaries **41%**	Ecological footprint calculators **31%** Activists reports **17%** Court rulings **10%** Other **9%**

Overall, there is a mix of conventional and experimental approaches to teaching climate change, using a broad range of teaching styles and resources. This suggests that it may be a worthwhile area for further research and collaboration in order to investigate how effectively climate change topics are taught, for example interviewing those respondents working with climate scientists, other academics, practice engagement and arts. There appears merit in hosting a workshop exploring different pedagogical approaches to teaching climate change and linking with other initiatives, such as UN PRME Working Group on Climate Change and Environment and SOS-UK Climate eLearning Workshops.

What challenges arise in connection with teaching climate change and/or sustainability?

As mentioned previously, an encouraging 81% of respondents stated that climate change and/or sustainability was covered in the accounting and finance curriculum in their departments and schools. We accept that, given the nature of our survey and our purposeful sample selection methods, this is unlikely to be a representative sample of all accounting and finance programmes. Our sample was biased towards those currently delivering climate change education and it is therefore not possible to generalise our findings.

However, given this sampling strategy, it is likely that there are important lessons to be learned when attempting to further expand this teaching provision or mainstreaming. For example, identifying the barriers these early innovators faced or reasons why they felt it was not possible to include climate change in the topics they teach, despite their recognition of the increasing importance of climate change and/or sustainability within both national and international political agendas, academic and professional journals and practicing accountants and professional bodies.

Respondents were asked about the main challenges that they experienced in teaching climate change. In Table 6 the barriers are grouped according to those that pertain to students, institution, staff resources and knowledge, and the profession. It is important to note that 19% of respondents stated they had not faced any barriers.

Interestingly the most popular response (35%) was the perception that students had little knowledge of climate change, which was followed by a cluster of responses over how to resource this transition. There is a need to respect that there is often limited time and space to

introduce new topics into already crowded working days and programmes. Even though the % responses are relatively small, challenges such as students' viewing climate change as irrelevant or a lack of support from a head of school are concerning and may hamper efforts to mainstream climate change into accounting and finance or wider university curricula.

From the perspective of staff a number of barriers were identified including time available, resources and uncertainty around integration of climate change/sustainability into modules. One respondent noted an absence of up-to-date case studies concerning strategy and risk management compared to a greater focus on disclosure requirements. Opportunities arise to share teaching resources and develop new teaching resources to support the further mainstreaming of climate change education into accounting and finance programmes.

Any change needs to recognise these barriers and there does seem to be potential for greater collaboration or programmatic interventions that could be assisted by a community of practice or leadership from external parties such as professional accounting bodies. Acknowledgement of these barriers should form the basis of any emergent community of practice. Further work may need to be conducted to understand students' perceptions of climate change and sustainability In order to develop further opportunities to co-create curriculum or learning activities[17] to support students to attain climate competencies to act in the public interest in accordance with professional standards.

TABLE 6: CHALLENGES ASSOCIATED WITH TEACHING CLIMATE CHANGE

Academics - Lack of Knowledge and Uncertainty	• supporting the development of competencies for sustainability **23%** • integrating climate change/ sustainability into existing modules **23%** • around module design, pedagogical approach and assessment **19%**
Academics - Resource Issues	• Time needed to prepare materials **28%** • Insufficient resources for teachers **23%** • Lack of time / capacity to develop knowledge & understanding **22%** • Not a priority over other topics **6%**
Institution	• I have not faced any barriers **19%** • not actively encouraged in my institution. **14%** • Insufficient support from Head of School **12%**
Profession	• Climate change is perceived as irrelevant to accounting / finance **16%**

[17] See for example Molthan-Hill et al 2020b where students conducted carbon footprint assessments and recommend measures to reduce GHG emissions.

	• Limited scope due to other accreditation requirements. **14%** • does not fit with accreditation **9%**
Students	• little knowledge of climate change **35%** • insufficient core knowledge of accounting/ finance **13%** • view climate change/sustainability as irrelevant **11%**

We were also able to gather information on the reasons why the 19% of the respondents do not currently teach climate change in their accounting and finance courses. 27% of the respondents who do not teach this topic felt that the main reason was that climate change was not thought to be a necessary part of accounting/finance education. The second most popular reason at 13% was that staff lacked sufficient knowledge of the topic. None of the other reasons seemed to be significant, including that it was not appropriate for accounting/finance programmes (7%) or that it was better taught elsewhere (7%) or not aligned with professional orientation of programme (3%).

What does appear to be the case is that levels of institutional initiatives are lower than the levels of teaching activities, which suggests these initiatives are not driving individual efforts to integrate climate change into accounting and finance programmes.

What should students learn in connection to climate change?

For most respondents, carbon literacy meant an individual and professional awareness of everyday activities on carbon levels, sources of emissions and awareness and motivation to reduce emissions across individual, community and organisational bases[18]. Some disagreement was evident with regard to the view that carbon literacy should include knowledge of or ability to conduct a climate risk assessment - with 16% of respondents disagreeing, while 38% also disagreed with the proposition that carbon literacy for accounting and finance education would include the ability to design a green finance instrument. This mixed response in relation to finance instruments may be due to scepticism towards market-based instruments as a means to address climate change.

Compared to carbon literacy, there was greater diversity as to how and where different aspects of climate change intersected with accounting and finance. The majority of respondents agreed that climate change is an urgent issue, but also that responses to climate change depend on how we view and frame climate change in the context of different worldviews. The pattern of responses suggested a strong intersection between climate change and mainstream accounting, finance and scientific thinking. There was less agreement (between 60% and 62%) about the connections between climate change and the arts and humanities, or confronting climate change as an object of power, inequality and colonialism. The only aspect of climate change that was rejected by the respondents was that climate change is a natural process. Only 36% of respondents agreed with that statement.

[18] See Table 9 in Appendix 3 for further details of respondents' views of what should be included in carbon literacy

TABLE 7: RESPONDENTS' VIEWS ON WHAT STUDENTS SHOULD KNOW ABOUT CLIMATE CHANGE

> 90% agreement	89-70% agreement	69 – 50% agreement
Climate change is an urgent issue **97%**	Climate change requires understanding links with biodiversity loss **89%**	Climate change is an issue of power/inequality/colonialism **62%**
Students' agency in addressing climate change **97%**	Climate change is man-made issue **88%**	How to design green finance instruments **62%**
Awareness of impacts of everyday activities on GHG levels **96%**	How humans respond to climate change is affected by worldviews **85%**	Value of arts and humanities for climate change **62%**
Ability and motivation to reduce individual, community, and organisational emissions **96%**	Hope we can address climate change **85%**	Emotional and psychological components of climate change **60%**
Framing of climate change influences possible solutions **95%**	How to assess climate risk assessment **84%**	
Awareness of climate change complexity **95%**	Role of natural science and climate change **82%**	
Transformations in social, economic, political, and ecological relationships. **95%**	Transformations & responses to climate change are underway **82%**	
Awareness of GHG sources **93**%	Indigenous knowledge is valuable for climate change / sustainability **73%**	
Ability to measure and report GHG emissions **93%**		

Our interpretation of these results was also supported by open text responses. These reflected deeper concerns about the roles of accounting and finance in society, concerns over the efficacy of mitigation rather than adaptation, the need to consider climate change with reference to related social-ecological issues, including planetary boundaries and to engage with environmental ethics, social justice as well as concerns over the capture of carbon accounting as part of neo-liberalisation. Overall these responses indicate support for a broad, socio-ecological conceptualisation of climate change from which to integrate with accounting and finance. Open text responses suggested other topics to consider including:

Deeper understanding of carbon & climate action

- Understand potential technological and behavioural mechanisms to reduce GHG emissions, including probable timescales.
- Understand the efficacy of the use and interpretation of relative and absolute numbers, across different scales and entities, including the quality of emission factors databases, which carbon prices to use or whether to monetize at all.
- Understand the whole carbon cycle including the dynamics of bio-geochemical cycles and the critical role of eco-systems in capturing emissions or as sinks.
- Understand the carbon cycle implications of new energy sources on global communities to ensure any solution is not designed for privileged societies, but for all humanity. Understand the impacts that organizations have on global GHG levels, distinguishing between public, private and third sector entities. This includes identifying the key institutions in this field.
-

Connecting climate change to social-ecological issues
- Understand climate change as part of the 'wicked problem' of socio-ecological sustainability
- Understand the sources and impacts of other primary and secondary pollutants that affect communities and natural systems.
- Understand the risks of framing climate change in managerialist language that has no clear connection to civil society or environmental ethics research.
- Understand the potential of alternative concepts such as degrowth.

Critical analysis of policy, professional developments, products, services and business models
- Understand the political, historical and technical genealogy of carbon accounting in order to identify potential limitations
- Understand the role of policies and perverse subsidies in promoting and perpetuating climate change.
- Understand the professional responsibility for the construction of reports for all decision-makers, especially local marginalised actors.
- Understand the limitation of accounting and green finance initiatives, in order to avoid cynical engagement in green markets to subvert potentially positive ecological and biodiversity impacts.
- Critically analyse different approaches to standardize or regulate environmental disclosure and other market based solutions such as circular economy, life cycle accounting or green finance.

Summary

The survey results suggest that climate change is being taught within accounting and finance education to varying degrees. Responses resonate with insights from management education and developments in higher education. Teaching and learning of climate change and sustainability in accounting and finance appears to continue to be driven by committed and

networked individuals. The challenges identified and contributions as to understandings of carbon literacy, competencies and knowledge for future professionals provide a starting point for all stakeholders to develop activities and resources to mainstream climate change across the curricula and contribute to initiatives across the sector.

CONCLUSION, RECOMMENDATIONS & FUTURE RESEARCH

The Building Carbon Literacy project has

- mapped the provision of climate change education in accounting and finance education across the world;
- identified understandings of carbon literacy and associated competencies that accounting and finance educators could incorporate into courses and degree programmes;
- identified challenges faced when teaching climate change;
- garnered interest in future activities and resources to support efforts to mainstream climate change in accounting and finance education.

The research demonstrates that individuals around the world are driving the incorporation and integration of climate change and wider sustainability issues into accounting and finance education. While the majority of climate change teaching is at an undergraduate level and incorporated into existing course (*piggy-backing*), it is promising to note specialisation in advanced degrees and efforts to feature climate change beyond optional courses such as social and environmental accounting or sustainability accounting. Building on the work of committed individuals and existing work, the research suggests that mainstreaming of climate change into accounting and finance education is possible. This mainstreaming will need to consider how to integrate strategic, normative, anticipatory, systemic working and interpersonal climate change competencies into accounting and finance programmes.

Recommendations

Climate change requires involvement of many stakeholders, including but not limited to academics, students, professional bodies, and higher education institutions. The following actions were identified as having the potential to further mainstream climate change education and associated topics, in order to make climate change a normal part of accounting and finance education and to ensure all accounting and finance institutions are aligned with efforts to tackle climate change:

- Deeper appreciation and effective communication of the relevance of climate change to accounting and finance
- Greater consideration of climate change issues in academic research, accounting associations and professional journals through special issues and associated conferences and workshops
- Promoting an interest in, and concern with, climate change by accounting and finance practitioners and professional bodies
- Inclusion of climate change in university strategies and vision statements and educational programme outcomes
- Dialogue with students to establish their demand for coverage of issues they see as very relevant to their day-to-day lives and future professional life
- Increasing the number of active researchers in the area of climate change

- Effective communication of professional bodies' recognition that climate change is a legitimate part of accounting and finance curriculum
- The development of a community of practice for an authoritative source of expertise on climate change accounting and finance to enhance academics' capacity to teach climate change and sustainability[19].
- The inclusion of climate change accounting and/or finance as an accreditation requirement by professional accounting bodies
- Development of standardised teaching resources (e.g. textbooks or case studies) accompanied by a portfolio of customisable teaching resources

Further research & knowledge exchange activities

This survey and accompanying literature review has identified a number of areas for future research including

- Desk-based research of UN PRME signatory reports to understand where and how climate change is covered as part of responsible management education
- Interviews with accounting and finance academics to further examine experiences, challenges of teaching climate change and sustainability
- Continue to use the survey to gather insights on the inclusion of climate change and sustainability in accounting and finance education across the world
- Media analysis of climate change education and the role of accounting and finance in supporting climate action
- Compare and contrast insights across management with accounting and finance through building connections with UNPRME Climate Change Working Group
- Investigate students' perceptions of climate change and sustainability
- Investigate curriculum design and explore opportunities for co-creation with students and align with other institutional initiatives
- Investigate professional curriculum design, innovative practice design, continuing professional development potential and explore opportunities for co-creation with professional institutes, practitioners and other stakeholders
- Investigate overlap, complementary of professional competencies under qualifications, graduate attributes
- Work with management scholars and other academics to enhance carbon literacy and associated training
- Explore the potential of a climate accounting and finance textbook
- Develop interdisciplinary or transdisciplinary educational materials and activities with others (e.g. climate scientists, climate justice campaigners) on topics such as critical

[19] Respondents selected a number of activities including contributing to, or utilising, an online database of teaching materials (97); Developing a community of practice (78); Participating in a roundtable discussion (40); and participating in interviews about teaching experiences (31)

examination of development of carbon accounting and associated ethical, social-ecological consequences
- Comparative policy analysis of higher education institutions and professional accounting bodies educational policies

We are aware that mainstreaming climate change in accounting and finance will involve a substantial collaborative effort. Individuals, networks and institutions could co-operate to co-produce programmes, modules, new pedagogic methods, teaching materials, texts, cases, assessments to name but a few.

Any contribution, no matter how insignificant you think it is, will make things better. We need your support. We cannot do this on our own. But together we could make a difference. If you are interested in being part of this movement, or would like us to join in your movement, please get in touch. We look forward to hearing from you.

To contact us, please email Centre for Social and Environmental Accounting <csear@st-andrews.ac.uk> using Building Climate Literacy in the subject line.

Join conversations on CSEAR Facebook Group (https://www.facebook.com/groups/121691174537092/) and following CSEAR on Twitter https://twitter.com/csearUK?s=20) or LinkedIn (www.linkedin.com/in/csear-uk-st-andrews-b5b95115b).

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APPENDIX 1: METHODOLOGY

The primary method for data collection was multi-language online survey that was open between August and September 2021. The survey was developed with reference to prior surveys of social and environmental topics in accounting education, literature and engagement with academics and professional body representatives. These steps are discussed in more detail below.

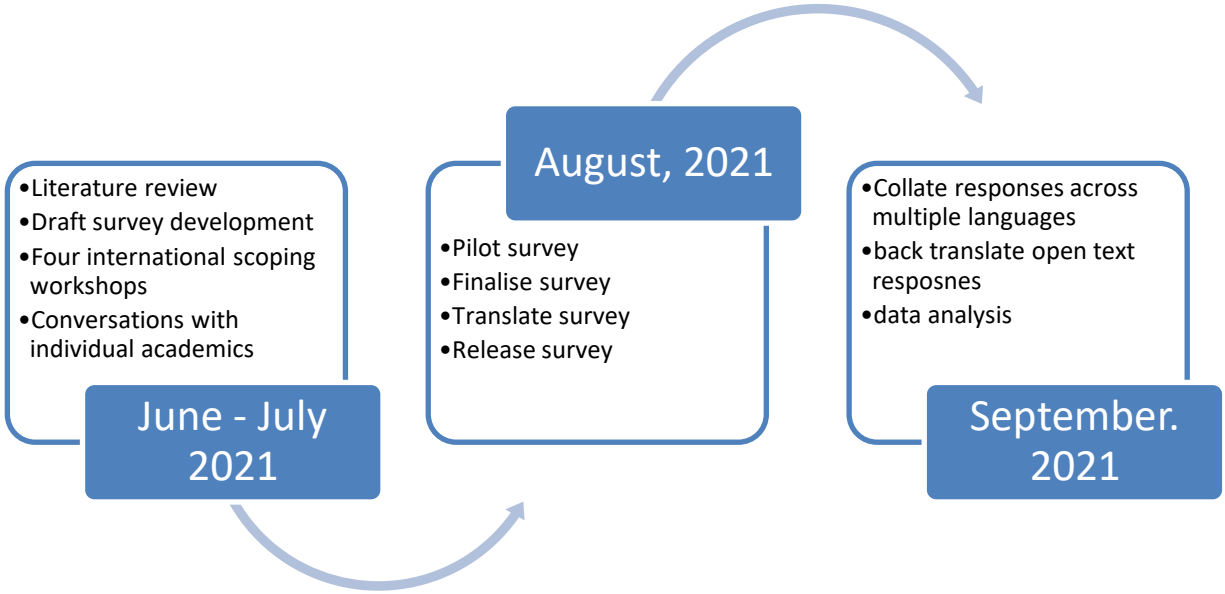

FIGURE 2: METHODOLOGY AND TIMELINE FOR INTERNATIONAL SURVEY

First, in June 2021, the team carried out a literature review as a basis for the survey development. The review focused on literature concerning climate change education in higher education and within disciplines of accounting, finance and management. The insights gleaned informed first draft of survey.

Second, four international scoping workshops were conducted with24 individuals affiliated with CSEAR and Centre for Responsible Banking and Finance alongside conversations with five further academics and five representatives from professional accounting bodies. Insights from workshops and conversations included identifying key barriers and challenges, terminology used, developments in different institutions or regions and reducing the length of the survey. Subsequently, a pilot survey was shared with workshop attendees and colleagues in July 2021. 15 individuals completed the pilot survey and provided further feedback enabling the final version to be released in August 2021. Ethical approval was provided from the School of Management University of St Andrews School Ethics Committee (MN15698).

To enhance international representation from non-English speaking respondents, the survey was translated into Simple Chinese, Traditional Chinese, Brazilian Portuguese, European Portuguese, Spanish, Italian and French. The languages were selected to cover the most often spoken languages but also were shaped by the CSEAR membership and interest in the subject of climate change education and accounting and finance. The surveys were released in waves during August allowing for social media advertisements and also the translation process to be completed. Respondents were able to indicate if they wished to be entered into a competition to win one of five copies *Sustainability Accounting and Accountability* (2021) by Helen Tregidga, Matias Laine and Jeffrey Unerman. The name of the winners were chosen at random and sent the book in October 2021.

The results were downloaded on 20th September for analysis. Data from the different versions were compiled. Data was cleaned and open responses were back translated to English. Results were analysed in Qualtrics and Excel. To understand regional patterns of provision, responses were aggregated with consideration of responses from institutions based in the Global North or South and respondents from high/middle and lower income countries according to the World Bank classification.

The survey will remain open and can be accessed via these links:

- English version: https://standrews.eu.qualtrics.com/jfe/form/SV_5AXjhioKLf1A6hg
- Version in Simple Chinese, Traditional Chinese, Brazilian Portuguese, European Portuguese, Spanish, Italian and French: https://standrews.eu.qualtrics.com/jfe/form/SV_0jn2aeb2UWkqR8y

APPENDIX 2: CLIMATE CHANGE EDUCATION INITIATIVES

TABLE 8 CLIMATE CHANGE INITIATIVES FOR HIGHER EDUCATION INSTITUTIONS

Initiative (see footnote for URL)	Further details
COP26 Universities Network[20]	A group of 80+ UK Universities and Research Centres working to promote a zero carbon future. Through the provision of evidence and expertise, the network has resources and activities including efforts to realise ambitions for net-zero universities across campus operations, educational offerings and engagement with student communities.
EAUC Carbon Coalition[21]	Consortium of higher and further education institutions in UK and Ireland working together to offset emissions through combined power and knowledge. The Wellcome Trust new requires institutions receiving funding to offset-related travel.
International Green Gown Awards[22]	The annual awards recognising sustainability initiatives being undertaken by the world's universities and colleges in support of the UN SGDs. Similar awards are available for institutions in the Australasia, France and the UK & Ireland. Categories including the development of academic courses relevant to sustainability.
Principles of Responsible Management Education[23]	A voluntary initiative with over 800 signatories that aims to engage business and management schools to ensure they provide students with skills required to 'balance economic and sustainability goals' alongside drawing attention to the UN SDGs.
PRME Working Group on Climate Change and Environment[24]	The working group aims to act as a resource for all organisations wishing to embed climate change and environmental education into their teaching..
Race-to-Zero for Universities and Colleges[25]	A campaign inviting institutions to pledge to reach net-zero GHG emission accompanied by commitments to plan, deliver against targets and publicly report on progress.
Students Organizing for Sustainability International[26]	A not-for profit association and formal educational partner with the United Nations Environment Programme that aims to glean insights into young people's perceptions of sustainability and collaborating on joint advocacy across campuses around the world.

[20] https://www.gla.ac.uk/research/cop26/
[21] https://www.eauc.org.uk/carbon_coalition
[22] https://www.greengownawards.org/international-green-gown-awards
[23] https://www.unprme.org/
[24] https://www.unprmeclimate.org/
[25] https://www.educationracetozero.org/
[26] https://sos.earth/

APPENDIX 3: ADDITIONAL INSIGHTS FROM THE SURVEY

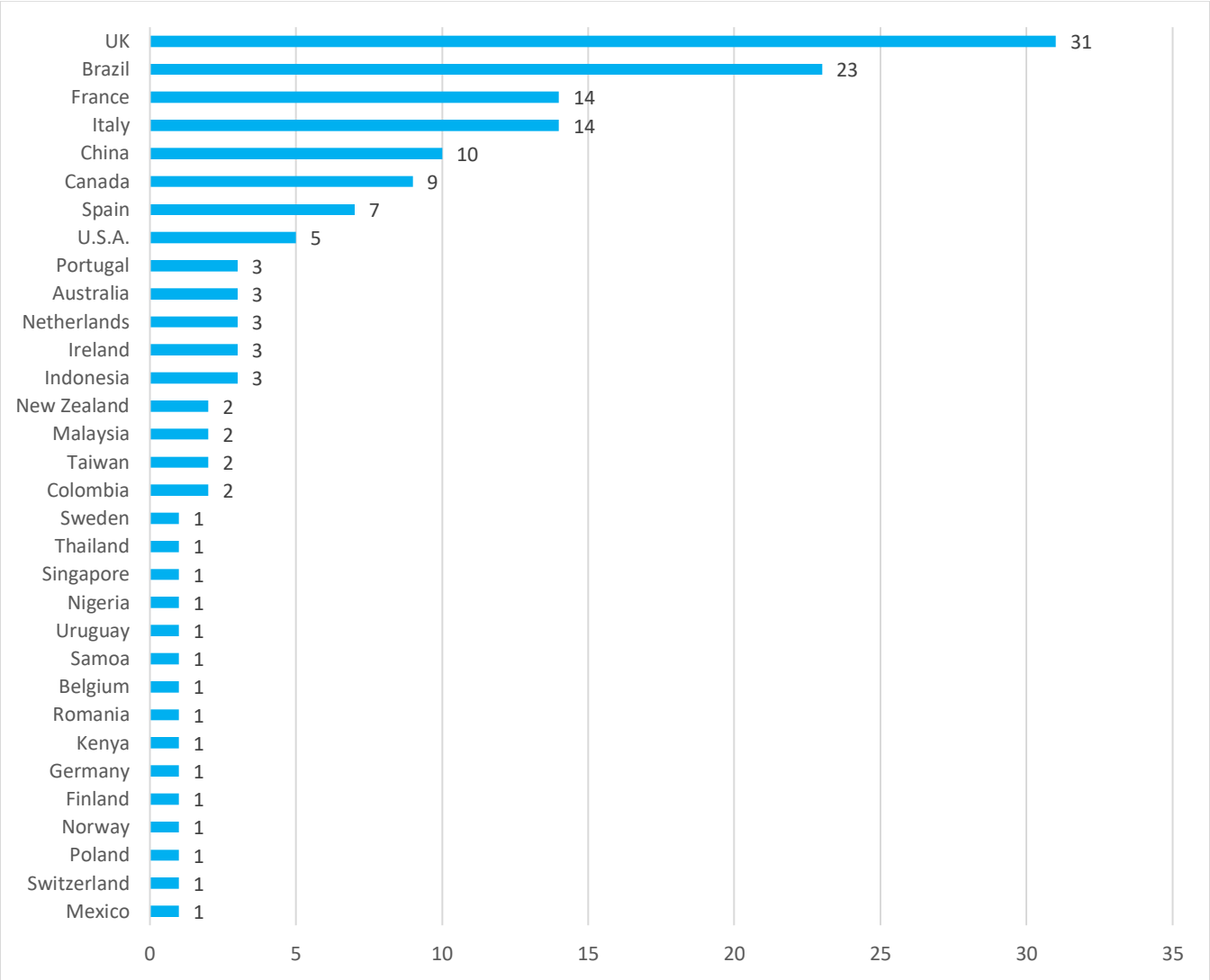

FIGURE 3: COUNTRIES WHERE RESPONDENTS' INSTITUTIONS[27] ARE LOCATED.

[27] One respondent worked in institutions based in two countries.

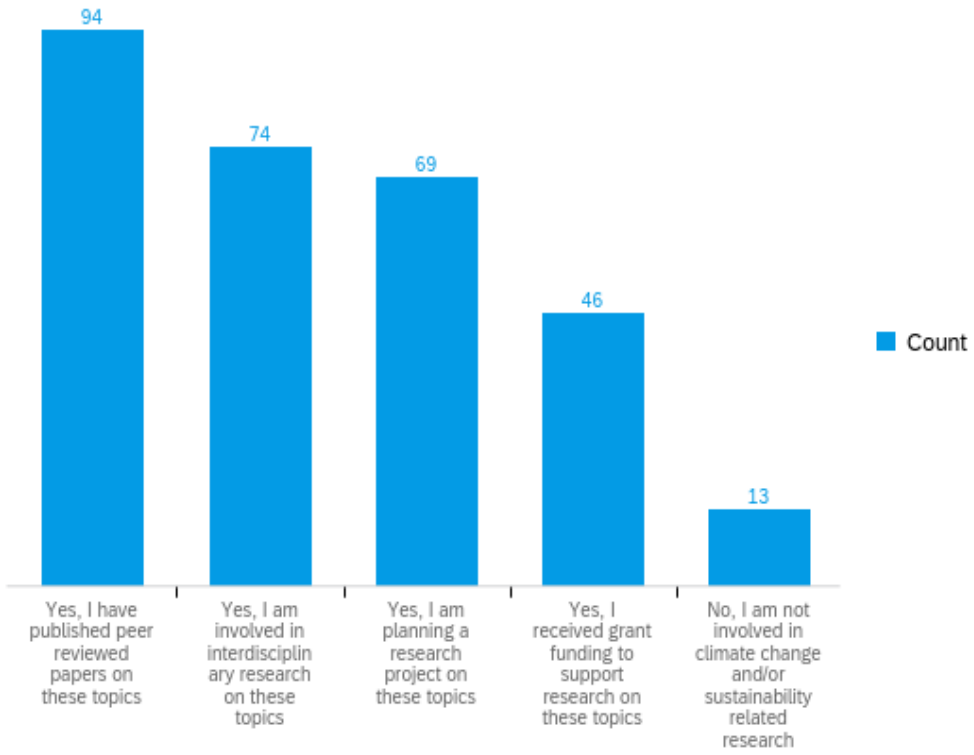

FIGURE 4: RESPONDENTS ENGAGEMENT WITH CLIMATE CHANGE AND/OR SUSTAINABILITY RESEARCH

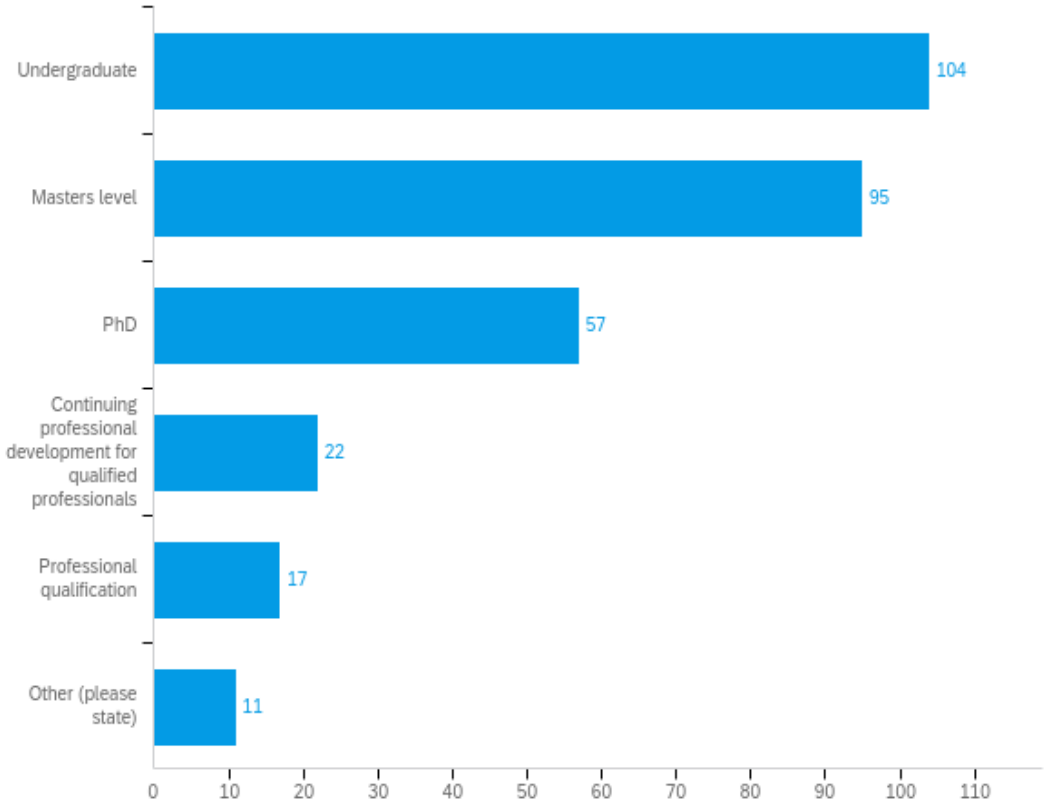

FIGURE 5: EDUCATIONAL LEVELS WHERE CLIMATE CHANGE AND/OR SUSTAINABILITY TAUGHT IN RESPONDENTS' DEPARTMENT

TABLE 9 UNPACKING CARBON LITERACY

Responses to the question "Thinking now about what 'carbon literacy' means to you in the context of accounting and finance education. Would you say the following aspects are central to carbon literacy (please answer yes, no or don't know/not applicable for each statement)" (n=138, where figures do not equal this total, respondents answered 'don't know/NA')

Question	Yes	Count	No	Count	Total
An awareness of the impacts of everyday activities on carbon dioxide levels	96%	132	4%	6	138
The ability and motivation to reduce emissions, on an individual, community and organisational bases	96%	132	4%	6	138
Awareness of the complexity of the issue	95%	129	5%	7	136
Awareness of the broad sources of emissions	93%	129	7%	9	138
The ability to measure and report on carbon emissions	93%	126	7%	9	135
Knowledge of or ability to conduct a climate risk assessment	84%	103	16%	19	122
Knowledge of or ability to design a green finance instrument	62%	75	38%	46	121

APPENDIX 4: CLIMATE CHANGE IN ACCOUNTING AND FINANCE LITERATURE

The following list of literature was collated as part of Thomson et al (2021) *Net Zero Accounting for a Net Zero UK*[28]. It could provide a starting point for educators wishing to find resources to support teaching and learning.

Carbon Accountants and Carbon Accounting Practices

Ascui, F. & Lovell, H. (2011). "As frames collide: Making sense of carbon accounting", Accounting, Auditing & Accountability Journal, 24 (8), 978-999.

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Bowen, F. & Wittneben, B. (2011). "Carbon accounting: Negotiating accuracy, consistency and certainty across organisational fields", Accounting, Auditing & Accountability Journal, 24 (8), 1022-1036.

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Green, W., Taylor, S., Wu, J., 2017. Determinants of greenhouse gas assurance provider choice. Meditari Accountancy Research 25, 114–135.

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[28] The report is available here https://www.birmingham.ac.uk/research/responsible-business/news/net-zero-uk/why-current-carbon-accounting-methods-threaten-to-undo-uk-plans-for-net-zero-and-a-green-industrial-revolution.aspx

Stechemesser, K., Guenther, E., 2012. Carbon accounting: A systematic literature review. Journal of Cleaner Production 36, 17–38.
Unerman, J., Chapman, C., 2014. Academic contributions to enhancing accounting for sustainable development. Accounting, Organizations and Society 39, 385–394.
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Miller, P., O'Leary, T., 2007. Mediating instruments and making markets: Capital budgeting, science and the economy. Accounting, Organizations and Society 32, 701–734.

Carbon Reporting and Disclosure practices

ACCA & GRI (2009). High-impact sectors: the challenge of reporting on climate change, Certified Accountants Educational Trust, London.
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