Emotions, Hope and Learning Experience of University Students in Climate Change

by

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Statement of Originality

I, CHAN, Ping Man Paladin, hereby declare that I am the sole author of the thesis and the material presented in this thesis is my original work except those indicated in the acknowledgement. I further declare that I have followed the University's policies and regulations on Academic Honesty, Copyright and Plagiarism in writing the thesis and no material in this thesis has been submitted for a degree in this or other universities.

Abstract

This study explores the emotions and hope towards climate change among university students of the programme of Bachelor of Education in the Education University of Hong Kong. Online survey was adopted to collected data about hope and emotions of 93 students in various disciplines. Results show that common emotions found among the students include worry, determined and powerless. Students also have mixed types of hope towards the future of climate change. While both *constructive hope* and *hope based on denial of climate change* are present, a specific idea of climate change denial has a surprising significant presence, with about a third of surveyed students have doubts about the linkage between climate change and human activities. As reflected in interviews with ten students, psychological distance can be used to explain much of the observed hope and emotions towards climate change. Meanwhile, observation of two lessons about climate change suggest more efficient strategies for climate change education at university level can be explored to make climate change education in university more relevant to tertiary students.   (173 words)

Keywords: climate change, emotions, hope, climate change education, university

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Lastly, I thank myself for finally accomplishing this goal.

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List of Abbreviations

CCE   Climate Change Education

EDB   Education Bureau

EdUHK   The Education University of Hong Kong

IPCC   The Intergovernmental Panel on Climate Change

UNESCO   United Nations Educational, Scientific and Cultural Organization

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Chapter 1 Introduction

1.1 Overview of this chapter

This chapter presents a comprehensive overview of a study that examines University students' perceptions of climate change, conducted by an educator affiliated with the Education University of Hong Kong. This chapter begins by providing the background of the research, which is followed by a delineation of the research problem. Subsequently, the research aims, objectives, and research questions are elucidated. Furthermore, the significance of the study is explicated, which is followed by a discussion of the limitations of the research. Lastly, this chapter is concluded with a summary of the remaining sections of the thesis.

1.2 Study background

1.2.1 Climate change

Climate change has gradually emerged as one of the most significant threats to humanity in recent decades. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "any change in climate over time whether due to natural variability or as a result of human activity" (IPCC, 1995, p.3). With the escalating situation of climate change, the need to adapt and mitigate its effects has become an immediate and pressing concern for humanity. In recognition of this urgency, the United Nations declared Climate Action as one of the 17 sustainable development goals in 2015. (Huckle & Wals, 2015)

The impetus for the present study arose from the researcher's teaching experience at the

Education University of Hong Kong, which places a strong emphasis on teacher education. Given the researcher's sustained attention to global environmental issues over the past eighteen years, the researcher occasionally reflected on how university students and future teachers could be prepared to confront the impending crisis of climate change. In recent years, the researcher has become increasingly interested in exploring learners' perspectives on this global issue, specifically their thoughts and feelings as they engage with climate change education. This interest has led the researcher to investigate the emotional aspects of climate change education as discussed in the literature.

1.2.2 Emotions when facing climate change

In the context of teaching undergraduate students about climate change, the researcher observed a contrast between students' apparent agreement with the importance of the issue and their non-verbal cues indicating a lack of enthusiasm for studying it. This discrepancy prompted the researcher to consider possible explanations for students' attitudes toward climate change. One possibility was that students may have already learned about climate change in the past, leading them to find the topic repetitive and uninteresting. Alternatively, students may have found the topic of climate change too heavy emotionally and overwhelming, leading them to avoid discussing it altogether. Both interpretations suggested the importance of emotions in the learning process, and the researcher wondered which interpretation was more accurate. Moreover, it also seems likely that other emotions also played a role. In such scenario, other interpretations may be possible.

As an educator who occasionally teaches about environmental issues, the researcher gradually realized through personal experience and literature that learning about global environmental issues such as climate change can be emotionally draining and depressing. Topics such as

extreme weather events, flooding, droughts, and heat waves are associated with significant potential losses for both human life and biodiversity, and constant exposure to this information through educational contexts or media may potentially produce negative emotions in learners. Iconic Images of climate change have been found to have a certain degree of association with emotions such as fear, powerlessness, hopelessness, and helplessness. (Nagel, 2005; O'Neill & Nicholson-Cole, 2009) This has become a significant global problem in recent years, as young people are feeling increasingly worried about climate change in international studies (Hickman et al., 2021). Without local data, the researcher could only speculate about how students in their university cope with negative news about climate change from their learning experiences and the media.

1.2.3 Hope in climate change

The researcher's concern extends beyond how students currently feel about climate change to how they perceive the future of this issue. Specifically, the researcher seeks to understand how students perceive the future of climate change given their knowledge of its impending crisis. The researcher questions whether students feel hopeful about the future of climate change or whether they avoid thinking about it altogether. The researcher finds the present inquiry particularly intriguing since the challenge of managing negative emotions and sustaining a hopeful outlook in the face of the global climate crisis is also pertinent on a personal level.

As the negative emotional impacts of climate change have gained attention in academic literature over the past decade, the researcher has come to recognize the significant role of hope in this age of climate crisis. The literature on hope suggests that it can have mixed effects on human behaviors. On one hand, hope is essential for coping with the stress and worries of facing the climate crisis (Ojala, 2012a). When combined with emotions, hope can also motivate

pro-environmental behaviours. On the other hand, hope can also represent wishful thinking and lead to the denial of necessary actions in response to climate change (Ojala, 2015). The subtle distinction between desirable and undesirable hope is therefore crucial in an educational context. While the topic of hope has been addressed in other countries, it remains a relatively less explored topic in the local context.

1.2.4 Learning experience of university students

When considering the learning experiences of university students regarding climate change, it is important to note that this community is highly diverse in terms of subject backgrounds, both past and present. Prior to attending university, students may have received education on climate change from a variety of subjects in their secondary school curriculums. After they have been admitted into university, they may have studied courses in diverse subject disciplines, only some of which are related to climate change. Additionally, students may have garnered knowledge about climate change through extracurricular activities and personal experiences. Compounding this diversity is the fact that university students also hail from a wide range of sociocultural backgrounds, further contributing to their personalized interpretations of climate change.

To comprehensively understand the emotions and hope of university students regarding climate change, it is essential to obtain anecdotal data on their individual perspectives. Although existing literature on climate change education can provide a foundation for understanding perceptions of students, it is necessary and valuable to conduct research on this specific community to verify these concepts. Such data should capture not only students' feelings and hope regarding climate change, but also their previous learning experiences. This will enable the study of the interaction between emotions, hope, and learning experience, ultimately

leading to a deeper understanding of the characteristics of university students.

1.2.5 From emotion and hope to climate change education

Based on our understanding of the university student community, it is our aim to utilize our findings regarding learners' emotions, hope, and learning experiences as a foundation for enhancing climate change education for future teachers. As climate change becomes an increasingly pressing issue, it is imperative that educators, particularly those at a university that prioritizes teacher education, prepare the next generation of teachers to address these challenges.

The notion that education should be a part of addressing significant contemporary problems is a recurrent theme throughout education literature. This idea has been particularly prominent in environmental education (EE) since its inception before the 1970s, and in education for sustainable development (ESD) since the early 1990s. The United Nations further emphasized the importance of education in this regard by declaring the UN Decade of Education for Sustainable Development for the period of 2005 to 2015.

The researcher has been involved in teaching interdisciplinary courses for the past eighteen years, and based on limited experience, holds a nuanced perspective. From an academic standpoint, interdisciplinary domains, such as Environmental Education (EE) and Education for Sustainable Development (ESD), have traditionally posed difficulties due to the disparate languages and traditions employed by the subject areas involved.

While some academics consider climate change education (CCE) as a sub-field in ESD, the researcher does not place such restrictions on its scope. In contrast to the fields of EE and ESD,

climate change education is more well-defined in terms of its focus. Given that threats posed by climate change are well-documented and supported by the scientific community, it seems the discussion and learning of CCE can be evidence based. Nevertheless, the implementation of climate change education presents its own unique challenges. The researcher perceives a significant challenge in addressing the imminent threats posed by climate change, as they transcend national boundaries and affect the global community. As such threats are based on scientific research and consensus of scientific community, there is limited scope for blind optimism. Hence the role of educators in guiding students to adopt a positive outlook based on evidence is a delicate balance to achieve.   The challenge lies in striking a balance between promoting a positive perspective while acknowledging the harsh realities of the situation.   The challenge of balancing optimism and realism in the discourse surrounding climate change is not limited to educators alone but extends to experts and scientists who possess a comprehensive understanding of the subject matter.

It is necessary to contextualize climate change education as mentioned in previous paragraph. Although climate change is usually considered an essential topic in subject curriculum of geography in secondary school, climate change education as described above has a much wider scope, and is acknowledged in scholarly literature as an interdisciplinary domain in research with its educational objectives described in details in UNESCO documents (Monroe et al., 2019; Anderson 2012). Consequently, educators are expected to integrate insights from diverse fields, including both natural and social sciences, to effectively impart the requisite knowledge, attitudes, and skills. This presents a complex challenge in curriculum design as learners from diverse subject backgrounds exhibit distinct aptitudes and limitations.

In addition to exploring the emotional aspects of learning about climate change, it is important

to consider how educators in universities should respond. While our data collection described thus far has focused on learners' perspectives, it is also essential to collect evidence on how climate change education is currently being implemented in university classrooms. By focusing on selected issues related to hope and emotions as revealed in our study, classroom observation should provide us with data about the reality of climate change education. This will enable us to develop evidence-based recommendations for improving climate change education in a localized context.

1.3 Research problem

As the researcher is studying this topic, there is an increasing awareness of the growing attention being paid to the emotional aspects of climate change. In recent media coverage, young people in other countries have been expressing their concerns about the urgency of climate change through various actions. However, research from other countries has also shown that negative emotions, and especially sense of hopelessness and helplessness, are becoming increasingly widespread among young people, which is a worrying trend for educators. The importance of hope has therefore gained more attention in educational literature.

The researcher is interested in understanding how university students in Hong Kong feel about the future of climate change. Given the strong socio-cultural dimensions of this issue, this research will focus on students enrolled in the Bachelor of Education program at the Education University of Hong Kong. This population is significant as they are both university students and future teachers. However, the search for available evidence on this topic has yielded limited results. This is why the researcher began planning this research project in 2020. As a university educator, it is imperative that we figure out how to prepare future teachers to address the challenges presented by the impending climate crisis. Therefore, gaining a deeper

understanding of how university students react to climate change is highly relevant and significant. Additionally, the researcher wanted to investigate whether their feelings and hope regarding climate change are influenced by their learning experiences, including those prior to and following their enrollment in university. Through this investigation, we can gain valuable insights to further enhance the emotional aspects of teaching and learning on climate change.

1.4 Research aim

The present study aims to investigate the emotional perceptions of university students regarding climate change. Specifically, the study seeks to explore the emotions and types of hope among university students in relation to climate change and to what extent these factors are influenced by their learning experiences. Given the importance of emotions and hope in students' motivation and effectiveness in the learning process, examining these factors can yield a deeper understanding of students. It is anticipated that the findings of this study will provide valuable insights for evidence-based modifications aimed at improving the efficacy of pedagogical and curriculum planning in CCE.

1.5 Research objectives

This study has three primary objectives that are described below.

The first objective is to examine how undergraduate students emotionally perceive their future in relation to climate change. Specifically, this objective aims to identify the common emotions and levels of hope among students regarding climate change.

The second objective is to explore the relationship between students' past learning experiences and their emotions and types of hope towards climate change.

The third objective of this study is to provide evidence-based recommendations for improving the emotional aspects of climate change education in the Bachelor of Education curriculum at the Education University of Hong Kong. These suggestions will be based on the findings of the study and aim to enhance the effectiveness of climate change education in terms of its emotional impact on students.

1.6 Research questions

The present study aims to investigate the relationship between emotions, hope, and learning experiences related to climate change among university students. To achieve this, it is necessary to identify the common emotions experienced by students and their specific ideas about the future of climate change. This will allow for the distinction between constructive ideas and those based on wishful thinking or denial.

The investigation of emotions and hope management in university classrooms is deemed necessary to inform curriculum development and suggest improvements to the implementation of climate change education at the Education University of Hong Kong. To achieve this goal, a research question is required to serve as a bridge between the preceding section of the study and the investigative process. By conducting a systematic inquiry, the study aims to generate specific and practical ideas for enhancing climate change education in the university setting.

Building on the preceding discussion, the following research questions will guide this study:

Research question 1 (RQ1): What is the relationship between hope and emotions to climate change among students of Bachelor of Education programme?

Research question 2 (RQ2): How do students' hope in climate change affect their perceptions of the future of climate change and their learning experience in the past?

Research Question 3 (RQ3): In what ways are emotions and hope in climate change education being handled by teachers in exemplar lessons in Education University of Hong Kong?

To address the nuances and details of the first two research questions, sub-questions will be added. The details of how to address these three research questions and sub-questions will be discussed in Chapter 3 of this thesis.

1.7 Research significance

Although the scientific aspects of climate change have been widely accepted by the scientific community, the reaction of the public to climate change is much more diverse and warrants examination of its psychological implications. Emotions, particularly hopefulness and helplessness, are strongly linked to motivation for future personal actions or inaction towards climate change, respectively (Wang et al., 2018). Given that discussions about the emotional implications of learning about climate change are relevant both inside and outside the university campus, investigating students' emotions and hope towards climate change has the potential to provide insights for both university educators and students.

In recent studies, the emotional aspects and importance of hope in climate change education have received considerable attention in other countries, including Sweden (Ojala, 2015; Ojala & Bengtsson, 2019). A study that focuses on the emotions and hope of university students and pre-service teacher education within a well-specified socio-cultural background becomes crucial as it provides a concrete context for professional discourse in teacher education. Although this study is conducted in one university with a specific social and cultural background, the interaction between emotions, hope, and learning experiences can still yield insights for evidence-based curriculum development in climate change education.

1.8 Study limitations

This study aims to explore the emotions and hope of a specific group of undergraduate students enrolled in the Bachelor of Education program at the Education University of Hong Kong. Due to the study being primarily conducted by an individual university teacher-researcher, it has a limited scope and a narrow population focus. As this study is based on data collected from a single university, the specific cultural and social background of the university may limit the generalizability of the results.

Despite efforts to minimize the impact of the researcher's dual role as a teacher and researcher, it is possible that the researcher's identity may have influenced the interpretation of students' interview data and classroom observations. The researcher's dual identity may also have affected how some students responded to the survey and interview during the research process.

It is important to note that the data collection for this study was conducted during a unique cultural and societal period in Hong Kong in 2021. These contextual factors may limit the

generalizability of the study's findings. The limitations of this study will be discussed in detail in the final chapter of this thesis.

The timing of the data collection during the COVID-19 pandemic necessitated the use of online surveys as the primary method of data collection, which posed significant challenges for the study. These challenges included a lower response rate for the survey and limitations on the amount of data that could be collected via the online survey. These limitations may have affected the data collection process and the study's findings.

1.9 Structure of this thesis

This thesis is divided into five chapters. Chapter One serves as the introduction and provides the background context to this study.

Chapter Two contains the literature review, where the major literature related to the conceptual framework of this research will be outlined. This includes literature related to climate change education and the emotional aspects of climate change education, which encompasses literature on hope and emotions about climate change. Additionally, the chapter examines major theories that help us to understand the interaction between hope, emotions, and learning experience from literature. Furthermore, the literature review explores how existing local secondary school curricula have dealt with climate change in recent years, which provides a better understanding of the knowledge background of the undergraduate students in the Bachelor of Education program being studied.

Chapter Three is dedicated to the research method. In this chapter, the mixed-method approach

used to collect data on the status of climate change education in the selected population of undergraduate students in the Bachelor of Education program will be described. The chapter will also provide a description of the tools used for data collection and will conclude with a discussion of validity issues.

Chapter Four focuses on the results and data analysis. In this chapter, the collected data will be presented, and a detailed analysis will be provided. The chapter also addresses the three research questions one by one.

Chapter Five is dedicated to the discussion and conclusion of the study. This chapter discusses the implications of the findings and provides suggestions for possible directions for future course development in the university curriculum for undergraduate preservice teacher education. The chapter also revisits some of the limitations of this study. It will also discuss the extent to which such limitations affect the validities of the findings. The conclusion of this chapter includes reflections on the study process.

In conclusion of this chapter, this study has provided answers to the original puzzles about students' emotions and hope towards climate change. Despite the limitations and flaws in the study process, it has provided a helpful framework to regulate emotions when dealing with the climate crisis. Such framework becomes highly pertinent on a personal level and professional level as it allows educators to remain calm and hopeful in a challenging time.

Chapter 2 Literature Review

2.1 Overview of this chapter

This chapter presents a conceptual framework for investigating the educational challenges of climate change, approached from the learner's psychological perspective. Against a historical background of complicated landscape of the field education for sustainable development (ESD), it is argued that climate change education should be considered as an independent field rather than as a sub-area in education for sustainable development. The framework centers on psychological coping with emotions in climate change education (CCE), with a particular emphasis on the role of emotions and hope. The chapter examines the critical importance of responding to climate change and its implications for educational institutions in the global community. Specifically, it explores emotional and psychological considerations in climate change education, including how learners cope with stress and worry. The subsequent discussion focuses on the implications of climate change education for undergraduate students in pre-service teacher education programs, based on an analysis of past learning experiences and relevant life experiences. Finally, the chapter outlines research opportunities that arise from the presented conceptual framework.

2.2 Climate change

Climate change represents one of the most significant environmental challenges confronting humanity today. Defined as "any change in climate over time whether due to natural variability or as a result of human activity" (IPCC, 1995, p.3), the issue has gained increasing prominence in recent years, with media reports frequently featuring extreme weather events such as heatwaves and melting polar ice caps and permafrost. The gravity of the situation is

underscored by the alarming data reported in global monitoring reports, which reveal a worsening trend of frequent natural disasters, as well as the Intergovernmental Panel on Climate Change's (IPCC) sixth assessment report released in 2022. The report warns of the increased occurrence of extreme weather events, including hot extremes on land and in the ocean, droughts, and wildfire, which are primarily attributed to human-induced climate change. As such, climate change is no longer a problem that will manifest in the future or for future generations, but rather a present-day reality that demands immediate attention from the global community.

2.2.1 Urgency of climate change situation

The issue of climate change has been a longstanding concern, dating back to the early 1990s, and international efforts have been focused on mitigating and adapting to its consequences ever since. Central to these discussions is the role of greenhouse gases, which are primarily emitted by human activities and identified as the primary cause of global warming. Consequently, international collaboration has largely centered on limiting greenhouse gas emissions, with a particular emphasis on reducing carbon dioxide emissions from fossil fuel combustion. Despite extensive discussion and negotiation, however, the goal of controlling greenhouse gas emissions has yet to be achieved, as highlighted in the IPCC's latest report in 2022.

2.2.2 Response to climate change

The urgency and significance of global efforts to address climate change cannot be overstated, as underscored in the IPCC's latest report (IPCC, 2022), which stresses the need to limit the rise of global average temperatures as soon as possible. Climate scientists warn that even a 1.5-degree Celsius increase in global average temperature, compared to the level two hundred years ago, would result in more frequent and severe extreme weather events, some of which would

increase non-linearly (Knutti, Rogelj, Sedláček & Fischer, 2016). The situation becomes much more serious with a rise of more than two degrees Celsius. To avert these potential catastrophes, the global community has set a target of reducing greenhouse gas emissions by 2030. Failure to achieve this goal would trigger irreversible changes in global climate patterns and lead to a significant increase in climate disasters. Given the proximity of the deadline, the threat of a global crisis is imminent in a very real sense.

2.2.3 Emotions and climate change

As the impacts of climate change in the physical world become more widely recognized by the public, it becomes unavoidable that more people find climate change are also feeling their emotions affected by climate change. The prevailing negative emotions surrounding climate change make it imperative to investigate its emotional implications since the last two decades.

Recent international studies have shown that young people are generally worried and anxious about climate change. As a prime example, Hickman et al. (2021) found that more than half of the 10,000 young people surveyed in ten countries expressed worry about climate change, with over half of the respondents feeling very or extremely worried. The same study also found that half of the respondents expressed sad, anxious, angry, powerless, helpless and guilt about climate change (Hickman et al., 2021)

In addition to feeling worried about climate change, young people also exhibit other damaging emotions as revealed from other studies. An example of such emotion is hopelessness which is observed among university students by Petersen and Barnes (2020). Based on such observation among their geography students, they encouraged fellow teachers to promote hope in their teaching. However, with limited data in academic publications, it remains unclear whether

young people in Hong Kong universities have similar emotional attachment to the issue of climate change.

Literature shows a clear relationship between emotions and personal actions, with emotions such as anger, fear, and guilt motivating behavioral changes (Leviston, Hurlstone, Lawrence & Walker, 2018). However, research also indicates communication strategies that deliberately invoke fear of environmental crisis may be counterproductive. O'Neil and Nicholson-Cole (2009) found that while some iconic climate change images including melting icebergs and starving polar bears can capture attention, those that caused fear of climate change may desensitize recipients, leading to apathy and denial.

A recent study by Chu and Yang (2019) identified seven emotions central to climate change communication: anger, fear, anxiety, sadness, guilt, shame, and hope. The authors confirmed that the emotions of anger, anxiety, sadness, and hope contributed to policy support and climate mitigation actions, while fear, shame, and guilt did not. Capturing these emotions in educational settings may therefore help to reveal learners' intentions to engage in climate mitigation actions.

The framework presented by Susie Wang in 2018 provides us some concrete ideas about how to explore people's emotional perception about climate change (Wang et al., 2018). In their study, a group of general citizens in Australia wrote about how they felt about climate change and then indicated their emotions on Likert scales. This resulted in emotional profiles of respondents that predicted their attitudes toward climate change policy. Using this framework, the same research found that climate scientists were more emotionally invested in climate change, showing more diverse emotions, including hope, anger, and frustration. A similar study can help understand the emotions of university students.

2.3 Climate Change Education (CCE)

As we are exploring the emotional aspects of climate change to university students, we readily recognize emotions should be considered in the bigger educational context. Not only that climate change is a topic that students should have learnt in their various stages in their education, but climate change is also happening in their real world they are experiencing. That is why we need to consider climate change education, as the educational response to climate change. The related literature is reviewed in the following sections.

2.3.1 The emerging CCE

Considering the deteriorating situation of climate change, the challenges associated with the educational response to this issue are becoming increasingly evident. At the core of this response is the origin of climate change education (CCE), which aims to address the crisis caused by climate change through educational means.

The growing urgency and gravity of the climate situation has led UNESCO to emphasize on the high stakes of climate change education in its documents as early as 2010. The Climate Change Education Programme, coordinated by UNESCO in 2010, had a very challenging aim to "help a broad audience understand, address, mitigate, adapt to the impacts of climate change, encourage the change of attitudes and behaviors to put our world on a more sustainable path, and build a new generation of climate change-aware citizens" (UNESCO, 2010: p.4). While one may argue the role and effectiveness of facilitating changes in our society through education as such described, this aim of Climate Change Education can be considered even more relevant today when the situation climate change become increasingly more urgent.

2.3.1.1 What is CCE?

In examining the nuances of climate change education, various definitions of climate change have been proposed, reflecting varying degrees of detail. One widely cited definition, offered by Stevenson, Nicholls, and Whitehouse (2017), characterizes climate change education as entailing "learning in the face of risk, uncertainty, and rapid change" resulting from climate change. For the purposes of the present study, a broader definition of climate change education is adopted, encompassing any educational efforts related to climate change across a range of educational levels from children to adult learners. It is believed this broad definition can capture the variety of learning related to climate change.

2.3.1.2 Objectives of CCE

To gain a comprehensive understanding of the goals and objectives of climate change education, reference can be made to the non-binding but authoritative documents prepared by the United Nations. In recognition of the importance of climate change education, Climate Action was designated as the 13th of the seventeen United Nations Sustainable Development Goals (SDGs) in 2015, with the explicit goal of "Take urgent action to combat climate change and its impacts". Two years later in 2017, the Education Sector of UNESCO compiled a list of fifteen learning objectives for Education for Sustainable Development Goals on Climate Action, which can be integrated into curricula at various academic levels at the discretion of educational institutions worldwide.   (UNESCO, 2017)

The following three paragraphs examine this list of learning objectives as they are highly relevant to our understanding of the challenges faced by CCE.

The cognitive learning objectives in the SDG of Climate Action encompass a wide range of knowledge related to climate change, including the greenhouse effect, human effects on climate

change, and the consequences of climate change. Learners are also expected to acquire knowledge on prevention, mitigation, and adaptation strategies at different levels, from the global to the individual level, as a response to climate change.

However, given the collaborative nature of tackling climate change, the socio-emotional learning objectives of climate action in the SDGs pose significant challenges. These objectives include encouraging others to protect the climate, collaborating with others to develop strategies to tackle climate change, recognizing one's own impacts on climate change, and recognizing the shared responsibility for protecting the global climate.

Given the severity of the impeding climate crisis, the behavioral learning objectives in Climate Action are also challenging. These objectives require learners to evaluate not only their own impacts on climate but also the impacts of local and national decisions and activities on other people and regions. Learners should be able to change their own practices, when necessary, promote climate-protecting public policies, and support climate-friendly economic activities.

Drawing on the list of educational objectives for climate change education, it is evident that this field encompasses a wide scope and presents significant challenges. For example, behavioral learning objectives require learners to understand how to respond to climate change at the global and individual levels, yet facilitating behavioral change through educational initiatives remains a longstanding problem.

It is also important to note the behavioral objectives of climate change education, as raised in UNESCO SDG Climate action, extend well beyond individual environmental behaviors and lifestyle. These objectives also include expectation that learners engage to promote climate-

protecting public policies, necessitating education institutions in all countries to provide training in the professional knowledge and communication skills required.

The phenomenon of climate change has prompted a call for individuals to adopt specific behavioral changes, such as adaptation and mitigation measures. Many of these behaviors and actions extend well beyond environment friendly behaviors. A systematic literature review was conducted by Carman and Zint (2020) on 75 research papers on adaptive behaviors in response to climate change. The result of this review was an extensive inventory of behaviors, including civic engagement, consumption behaviors, learning, lifestyle changes, household protection, and even migration. It is evident that these behavioral modifications, including civic engagement, have varied social implications. For a society to take the issue of climate change seriously, it is imperative to deliberate on how to integrate these behaviors into an educational context.

However, even when the learning objectives of climate change education were already presented in SDG Climate Action, designing educational programs for climate change must consider the specific situations of different societies, requiring local adaptations of the learning objectives. Educational initiatives must be tailored to each target group, including learners of different age groups and institutes of higher education seeking to implement effective educational initiatives for combating the climate crisis.

To achieve the listed educational objectives for SDG Climate Action, the UNESCO document also included a list of suggested topics for educational initiatives for climate action, as well as suggestions for learning approaches and methods. These included role-playing, inquiry-based projects, action projects or campaigns, case studies, and data analysis of different climate

change scenarios. (UNESCO, 2015)

The optimal approach for the implementation of climate change education necessitates a concerted effort among experts from diverse fields. However, in the event coordination among these individuals are not present, frontline educators may take on the responsibility of designing and implementing climate change education initiatives. In such instances, the learning objectives proposed by the SDG Climate Action are still good references for enthusiastic educators.

2.3.1.3 Relationship between CCE and education for sustainable development and environmental education

Before proceeding to reviewing the challenges of CCE, it is necessary to delineate the literature basis of current study. Historically, contemporary discussion about climate change in literature is often associated with the field of education for sustainable development.

The present study refers to SDG 13 Climate Action as a basis for the objectives for climate change education. However, while many scholars including Anderson (2012) consider CCE as a sub-area in education for sustainable development, this current study is skeptical about continuing such emphasis. Instead, the present study argues that while SDG may provide a basis for the starting point of discussion of the scope of CCE, it is necessary to expand the scope of literature basis and look beyond the field of ESD for feasible ideas and practices from more recent studies. At the same time, the author also cautions about the relevance of sustainable development to current discussion on climate change education in recent years. To explain why such a position is appropriate, we need to examine briefly some of the relevant controversies surrounding education for sustainable development briefly in the next three

paragraphs.

Historically, the call from UNESCO to consider climate change education within the framework of education for sustainable development has been met with criticism due to the limitations of such an orientation. Since education for sustainable development emerged from the field of environmental education in the early 1990s, it had remained as the platform for international community to discuss educational responses to global environmental issues. However, the diverse agendas and priorities of different stakeholders can often lead to confusion and distraction. (Jickling & Sterling, 2017) While climate change is one of the environmental problems addressed by education for sustainable development, it is not the only one. For educators who wish to focus their attention on urgent environmental issues such as climate crisis, the wide scope of agenda of sustainable development may be a mixed blessing. On one hand, wide scope of sustainable development allows the educators to discuss climate change from different perspectives and consideration of multiple factors, including social, economic, and even institutional. On the other hand, the lack of clarity in the agenda of education for sustainable development has led some researchers to criticize the positioning of climate change education within its umbrella. One may even argue if such diversified agenda is compatible with the urgency of climate change.

Furthermore, it is worthy to note that the interpretation of sustainable development as a strategy to tackle global issues has long been subject to doubt and criticism from some scholars. (Jickling and Wals, 2008) One of the most direct criticisms about sustainable development challenges whether current practices in our society can be sustained in face of environmental crisis. The review of the United Nations Decade of Education for Sustainable Development by critics Huckle and Wals (2015) at its conclusion highlighted the "business as usual" undertone

in many previous discussions of sustainable development within the United Nations framework. Given the urgency of the global climate issues facing the world, further debates about the relevancy of sustainable development in climate change may be distracting and possibly detrimental to the urgency of CCE.

The macroscopic nature of the agenda of sustainable development, which is usually characterized by a discussion of policy at the societal or even national level, is another source of continuous tension in education for sustainable development. As policy making about sustainable development in real world often involved complicated considerations involving multiple stakeholders, attempts to deal with such complexity within an educational context may likely continue to be challenging and controversial. (author's opinion)

In summation, the examination of climate change education within the framework of education for sustainable development presents both advantages and drawbacks. However, given the pressing nature of the climate crisis, a more focused effort is necessary in present study. it may be advisable to contemplate climate change education without confining oneself to the literature on education for sustainable development or environmental education. In this regard, research on climate change education can benefit from the knowledge gained from experience of both environmental education and education for sustainable development. Nevertheless, as research on climate change over the last two decades has also arisen from psychology and other social science fields, we need not limit ourselves to either EE or ESD when seeking innovative approaches for future of CCE.

2.3.1.4 Challenges of Climate Change Education

Given the high stakes of climate change, various forms of climate change education have been integrated into various stages of education. However, such initiatives face several challenges, particularly in terms of communication. Despite the significance of climate change education, the means of communicating its messages remain subject to ongoing research.

A systematic review by Monroe et al. (2017) identified two themes among successful pedagogical designs in climate change education research. The first theme emphasizes the importance of making climate change education personally relevant and meaningful, while the second theme concerns the design characteristics of educational interventions to engage learners. While both themes are important for pedagogical research, the former theme presents educators with both challenges and opportunities. To make CCE more relevant and meaningful for the learners, it requires careful consideration of psychological factors, which will be elaborated on below.

It is argued that to make climate change relevant and meaningful for the learners, consideration of psychological factors is important. Examples of such factors include students' motivation, and how students' emotion to the learning about climate change. Further, there is also strong evidence to suggest that ignoring emotions and hope in CCE can have serious negative consequences to student's learning. These are explained in the following paragraphs.

2.3.2 The psychological considerations of climate change education

In the context of climate change education, more exposure to environmental issues does not necessarily lead to desirable outcomes, as shown by experience in environmental education

research. In fact, there is a possibility that continuous exposure to environmental issues during schooling age can have negative impacts on children's attitudes, including lowering their sensitivity to such messages and dampening the effectiveness of further educational efforts. Moreover, long-term exposure to environmental messages may also instill apathy and "learned hopelessness" in students, which is associated with pessimism and an inability to see possible solutions. (Nagel, 2005) Hence, educators must be mindful of such pitfalls in the pursuit of climate change education.

Pedagogically speaking, psychological considerations are always essential for educators to engage learners effectively. To make learning about climate change personal, relevant, and meaningful, two psychological considerations appear to be in competition with each other. The first consideration involves making learners aware of the relevance of climate change to their own lives before they can take action to respond to the issue. In essence, individuals need to realize that climate change will affect them or someone they care about (Wang et al., 2018).

The second consideration involves ensuring that learners do not feel overwhelmed or drowned by the negative messages associated with climate change. From the learners' perspective, as many environmental issues, such as climate change, become more serious each year, learning about these issues can be a gloomy experience. Such gloom-and-doom messages can cause stress and worry in learners, which can be counterproductive to education (O'Neill & Nicholson-Cole, 2009; Ojala, 2012b; Chapman et al., 2017). Among other negative consequences, such stresses and worries can cause a sense of helplessness and hopelessness, as mentioned previously (Nagel, 2005; Ojala, 2012b).

These psychological considerations when learning about climate change have long been

recognized as a challenging issue for more than a decade. In a report compiled by the American Psychological Association professional group in 2009, some of the challenges of communicating global climate change were already apparent (Swim et al., 2009). According to this report, many people have difficulty perceiving the impacts of climate change because much of the effects of climate change are often not observable by first-hand experience, or only observable in a longer time frame. At the same time, many people consider the causes of climate change to be outside their personal influence or control. All these factors easily lead people to psychologically distance themselves from this issue or even deny that climate change is happening (Swim et al., 2009).

Apart from learning about environmental issues from academic sources, young people nowadays are also exposed to messages about environmental issues from various media, including news and social media, as well as visual presentations in documentaries and movies. However, these media often portray climate disasters and apocalyptic events caused by the climate crisis. Whether such exposures to media have any effects on young people is an issue that is worth exploring further. Studies such as Svoboda (2016) summarize some of the environmental messages in movies about climate change, while also drawing attention to a set of guidelines for effective climate change communication (Markowitz et al., 2014). Many of such guidelines share similarity to those highlighted by Monroe et al. (2017), including making climate change meaningful and relevant to your audience. Such works can inform curricular and pedagogical designs in CCE.

This problem of negative emotional impacts caused by exposures to environmental issues has drawn attention both in the educational context and in the public sphere. Recent research in climate change communication examines how to present climate change messages while

considering the emotional reactions of the recipients. Even when information presented about climate change events is fact-based, the framing of these events featuring fear or hope can affect the effectiveness of communication (Nabi, Gustafson & Jensen, 2018). The results from this paper also highlight the presence of emotional experiences in enhancing persuasive effectiveness of climate change messages in generating desirable behaviors. (op.cit.)

Recent studies in psychology have provided further insights into how learners respond to the stresses and worries caused by learning climate change. Ideally, from an educational perspective, learners can respond to environmental issues by taking actions that contribute to climate change mitigation and adaptation. However, learners can also respond by adjusting their own interpretations of the messages they are receiving, which may be modulated by their existing beliefs, emotions, and hope about it. Studies in psychology shed light on how learners process their emotions about climate change, which previously was not given enough attention in climate change education. In contrast to literature which focuses more on the curriculum aspects on CCE, approaching climate change education from a learner-centered perspective can potentially make significant contributions. Some selected works are reviewed in the following sections.

2.3.2.1 Psychological coping

Several years after the American Psychological Association published its report on climate change, Swedish researcher Maria Ojala started a series of studies over the last decade to investigate how young people perceive climate change (Ojala, 2012a, 2012b, 2015, 2018). She found that individuals use various *psychological coping* strategies to manage the stresses and worries associated with learning about environmental issues, including climate change (Ojala, 2012b). The implications of these strategies for climate change education are diverse and

significant, which we discuss in the next three paragraphs.

The first coping strategy as mentioned by Ojala (2012a), problem-focused coping, involves individuals being proactive and focused on solving the problems that cause stress and worry. From an educational perspective, learners employing this coping strategy may be more receptive to learning how to address climate change (author's opinion). Such learners may therefore benefit from learning various strategies of climate change mitigation and adaptation.

The second type of coping strategy used by learners is emotion-focused, which entails focusing on how to manage the emotions arising from the stresses and worries associated with learning about environmental issues (Ojala, 2012b; Chu & Yang, 2019). These strategies include psychologically distancing oneself from the issues or denying the problems or their severity to avoid stress and worry (Trope & Liberman, 2010; Ojala, 2012b).

Identifying learners using emotion-focused coping strategies in an educational setting presents challenges for educators. Learners may choose to minimize the emotional impacts of the messages they receive if they do not like them, either consciously or unconsciously. Educators may need to account for these emotional aspects of the learning experience in their pedagogical planning. However, emotional reactions in learners also present opportunities for reflection. With proper guidance from teachers, learners can reflect on the connection between their emotions and their beliefs and attitudes toward climate change (author's opinion).

The third possible coping strategy is meaning-focused, achieved by exploring the personal meaning of dealing with the situation. These strategies are particularly relevant when the problem concerned cannot be solved readily (Ojala, 2012b). In the case of climate change,

meaning-focused coping strategies have received considerable attention from researchers as studying them can provide insights into climate change education.

For meaning-focused coping, hope is considered an essential positive emotion that can counteract despair and helplessness (Ojala, 2012a, 2012b, 2015, 2018). Since hope is very crucial in our discussion of climate change, it will be discussed in more details in the next section.

These coping strategies proposed by Ojala (2015) encompass a range of inter-related concerns about emotions and hope, which have been reviewed in climate change education research and warrant further discussion.

It is important to note that these emotion-focused coping strategies as previously mentioned can be explained by the construal-level theory of psychological distance. This theory was first proposed by Trope and Liberman in 2010. It posits that people conceive themselves as the center of the mental world, with the central point representing the real experience of "me, here, now." As individuals move away from this central point, the psychological distance increases, requiring more abstract mental construal. Events become less relevant, less real, or less likely to be real. In essence, learners prevent stress and worry about climate change by perceiving the problem as not relevant to them, happening far away or far into the future, or affecting only other people not close to them (Trope & Liberman, 2010). Lastly learners may choose to believe that climate change is not happening or not so serious. Such belief exhibits in learners who are easy to accept skepticism against scientific claims of climate change, resulting in climate change denial.

2.3.3 Hope
2.3.3.1 The importance of hope

The importance of hope has gained significant recognition in recent years, particularly in the context of environmental and climate crises. Influential public figures, such as environmentalist Jane Goodall, have emphasized the critical role of hope. Goodall's personal experience has led her to define hope as the desire to achieve a certain outcome, which requires effort to make it a reality. She considers hope as a survival trait and distinct from optimism, stating that "without hope, all is lost" (Goodall and Abrahms, 2021). While Goodall's interpretation of hope may not align with scientific principles, her emphasis on the significance of hope in addressing contemporary environmental and climate challenges serves as a reminder of its pivotal role in educational initiatives. While various definitions of hope exist in literature of different origins, it is very clear hope is important for us to be more resilient in face of challenges and difficulties.

The literature on psychology has extensively studied hope in recent decades, with Snyder's (2002) hope theory being widely quoted. This theory defines hope as the perceived ability to identify pathways towards desired goals and to motivate oneself through agency thinking to utilize those pathways. Hope is often considered a two-part construct consisting of *agency* and *pathway thinking*. *Agency* refers to goal-directed energy or *willpower*, while *pathway thinking* involves planning to meet goals or *waypower* (Snyder, 2002). Based on this construct, hope can be experienced when an individual has a desired goal and can envision a feasible way of achieving it. Based on Snyder's work, a succinct definition of hope is summarized by Ojala (2015), which state hope is defined as "positive feeling about the future that is related to positive expectations about a desired goal."

The role of hope in influencing behaviors has been highlighted in research, such as Chadwick's

(2015) work, which suggests that evoking hope is critical for persuasive communication in climate change education. As hope is a future-oriented emotion, it can motivate positive behaviors that can contribute to addressing climate change. Recent research has focused on the importance of hope in various educational initiatives related to climate change, largely based on Snyder's hope theory. For instance, instilling pathway thinking in communication can promote a sense of hope among individuals willing to discuss climate change (Gieger et al., 2019). This approach is particularly relevant as the issue of climate change is widely recognized, but discussions on its solutions remain limited. Therefore, in addition to emphasizing the need to respond to climate change through actions, feasible and effective strategies should be explored to tackle this problem. These ideas can be integrated into the design of curriculum and instruction for climate change education to enhance participation.

2.3.3.2 Different types of hope

It is important to approach the identification of hope as a desirable outcome in climate change education with caution, as hope can originate from vastly different mindsets and may not necessarily lead to environmental actions. The literature on the effects of hope on personal motivation can be difficult to parse, as hope can refer to both constructive and passive attitudes towards actions and behaviors. While people may feel hopeful when they see viable solutions to the problems they are facing, they may also feel hopeful due to wishful thinking or fantasies based on an inaccurate view of reality.

These two different types of hope were distinguished by Ojala (2012a, 2015) as *constructive hope* and *hope based on denial* of the seriousness of climate change. Both types are defined in relation to their correlation with self-reported environmental actions. *Constructive hope*, as defined by Ojala (2015), is positively correlated with engagement in pro-environmental actions

in respond to climate change. These actions include various environmental actions, such as water and energy conservation, or helping environmental courses through donating money to NGOs and voting.

In contrast, *hope based on denial* of the seriousness of climate change, as defined by Ojala (2015), is negatively correlated with engagement in pro-environmental actions. Ojala identified *hope based on denial* based on whether respondents believe in statements about the causes and effects of climate change, and whether they believe in what scientists say about the seriousness of climate change. (Ojala, 2015) In essence, climate change denial is defined as denying either that climate change is happening or denying the attribution of the problem, such as human activities as the main cause of climate change (Jylhä, Tam & Milfont, 2021). Learners with such mindsets may assume that problems of climate change can be magically resolved, hampering motivation to tackle the problem through actions and behaviors.

When people deny that climate change is a serious problem, they are unlikely to take any action to address it. Furthermore, the presence of such denial may foster a false sense of naive optimism or false hope in learners, thereby resisting further messages about the necessity of responding to climate change through concrete actions. That is why climate change denial has become a problematic social phenomenon in some countries. At the societal level, widespread climate change denial among citizens can derail policy efforts to tackle climate change, such as regulating greenhouse gas emissions from fossil fuel combustion in energy generation.

Ojala's attempt to address the issue of climate change denial through research is significant for climate change education, as it highlights the need to discuss climate change denial in educational contexts. It is crucial for educators to be aware of the fine distinction between these

two types of hope. Educational initiatives should be designed to nurture and foster *constructive hope* in learners, while helping them to identify and dispel *hope based on denial*, which is inconsistent with the reality of climate change and counterproductive to addressing it.

Recent years have seen increased attention from social psychology researchers on the problem of climate change denial. For example, Jylhä, Tam, and Milfont (2021) conducted a cross-cultural study investigating climate change denial among populations in Hong Kong, New Zealand, and Sweden. The study found that climate change denial in Hong Kong can be predicted by whether respondents accept human domination over nature and animals. Further investigation can explore whether climate change denial is a widespread problem among university students in Hong Kong.

While there are separate attempts to present different constructs for hope, Ojala's work remains relevant from an educational perspective. Ojala's hope scale items in 2015 were developed with reference to educational concerns about climate change education, specifically highlighting the issue of climate change denial, which has become an alarming issue in contemporary discussions of climate change in society. This makes Ojala's conception of hope more readily linked to learning experiences related to climate change.

Such discussions about psychological implications and hope have led Ojala (2015) to suggest the importance of emotional awareness in climate change education, showing that teacher's emotions may unknowingly affect their communication with students regarding contemporary issues such as climate change.

2.4 Climate change in Hong Kong curriculum

Hong Kong is a Special Administrative Region of China with a very specific socio-cultural background. As a metropolitan city and a high population with more than 7 million people, Hong Kong is a place with high Human Development Index 0.952 in 2021, which is four highest in the world (UNDP, 2022). The figure means that compared with the rest of the world, people in Hong Kong have high life expectancy, long years of schooling completed, and high per capital income. (op. cit.) Because of historical and cultural background, the city also has influence from both Chinese and western cultures.   As a metropolitan city, most of the inhabitants spend most of their time in well-built urban environment separated to the nature.

The current study focuses on the educational context of Hong Kong, particularly the previous learning experiences of young people before entering university. For this purpose, the integration of climate change education into the Hong Kong secondary school curriculum is examined to shed light on the issue.

With its unique socio-cultural background, the education system in Hong Kong features a six-year primary school and six-year secondary school curriculum. Students commonly study for three years in their fourth to sixth year in their senior years in secondary school, before sitting in the Hong Kong Diploma of Secondary Education (HKDSE) examination. Under the current curriculum structure of HKDSE, students need to study four compulsory subjects in which include Chinese, English, Mathematics. Liberal Studies was also a compulsory subject, but it had been phased out and replaced by the new subject Citizenship and Social Development starting from 2021. Apart from these four compulsory subjects, students can study two to three elective subjects. Such elective subjects include geography, economics, and science subjects. The three science subjects of physics, chemistry and biology are offered either as individual

electives, or as combined science electives. Apart from these compulsory and elective subjects, students are also required to include fulfill the requirement of Other Learning Experiences which can be various related to moral and civic education, community service, career-related experience, aesthetics development, and physical development. (EDB, 2017) A natural result of the curriculum structure is that students will have different subject combinations in the senior years in secondary school.

Despite being an important contemporary issue, climate change has a limited presence in the Hong Kong school curriculum. While climate change is included in the curriculum of various subjects in secondary school, there is little evidence to suggest that it is perceived as a high priority.

A systematic analysis of the curriculum contents related to climate change was conducted by Jackson and Pang (2017), which compared the number of hours of learning related to climate change education in the local Hong Kong Diploma of Secondary Education (DSE) curriculum and the International Baccalaureate (IB) curriculum. It was observed that the study of climate change in the DSE level or IB curriculum is highly concentrated in certain subjects, namely Geography in DSE and Environmental System and Society in IB curriculum. As the local curriculum in secondary schools are more relevant for most students enrolled in local universities, the related subject curriculums will be analyzed in the following sections.

However, before we proceed to review the local subject curriculum, it is necessary to note an important distinction in the curriculum content related to climate change. While climate change is often discussed interchangeably with global warming in the mass media, the former phenomenon is more complex and has wider implications, such as increased frequency of

extreme weather events. Different subjects in the Hong Kong school curriculum make a clear distinction between the two terms, which has profound implications for the content of the related subject curriculums. Having mentioned that, we will review some key curriculum of secondary school in the next section.

2.4.1 Geography curriculum

Given that geography deals with the interaction between humans and the environment, climate change occupies a significant place in its curriculum. A keyword search of the latest geography curriculum document for junior secondary school (S1-S3), which was last updated in 2017, reveals that the term "climate change" appears 47 times. Additionally, the topic of climate change is explored in greater details as an elective module titled "Changing Climate, Changing Environment" in the same curriculum document.

In the senior secondary curriculum for geography, climate change is also addressed in considerable details, as it is one of the seven issues covered in the compulsory component of the latest curriculum version, which is also updated in 2017.

With such emphasis on climate change, it is worth noting that both climate change and global warming are mentioned in the senior secondary level geography curriculum document. However, as we will discuss in the following paragraphs, this is not necessarily the case for other subjects.

Even when climate change is mentioned frequently in the geography curriculum, it is important to exercise caution when examining the treatment of climate change in the geography curriculum. It is noted that the scope of discussion related to climate change can differ quite

significantly from what is being discussed in broader society. Li and Monroe (2019) noted in their study of climate change education that some respondents did not associate climate change with the contemporary environmental climate crisis. This is not surprising when considering how climate change is discussed in the curriculum context. For instance, depending on the topic under discussion, the issue of climate change in the geography curriculum can be examined on timescales of decades, centuries, or even millions of years in geological timescale. In cases where longer timescales are considered, the role of human activities in affecting climate change (anthropocentric climate change) may not always be significant or dominant until the last couple hundred years.

This long-term perspective on climate change, as described above, may be in stark contrast to the contemporary issue of climate change as portrayed in the mass media. In the latter case, the primary focus is typically on climate changes occurring in recent decades and the near future. Although it is not always explicitly stated, discussion of climate change in such instances is often linked to the impacts of various human activities, such as the consumption of fossil fuels, on global warming. We can explore the implication of such subtle differences in the meaning of the terms in research.

2.4.2 Science subject curriculums

In contrast to the geography curriculum, the coverage of climate change in science subjects at the Hong Kong DSE level is rather limited to the phenomenon of global warming. It is observed that the term "climate change" is largely absent from the curriculum documents of Biology, Physics, Chemistry, Integrated Science, and Combined Science. Instead, the term "global warming" has considerable presence in these subject curriculum documents. As these science subject curriculum documents were last updated between 2015 and 2018, they are reasonably

up-to-dated with relevant contents about important contemporary issues, including the scientific basis of global warming.

While energy consumption and its relationship with greenhouse gas emissions are typically discussed in different science subjects, other societal factors of the global warming may also be mentioned as the science-technology-society-environment (STSE) connection of the subject contents in these curriculums. For example, the environmental impacts of increasing population are discussed in the biology curriculum, which is also a major driving factor in climate change.

2.4.3 Liberal Studies curriculum

Apart from geography and science subjects, there are other opportunities to include climate change in Liberal Studies, which was a core subject in the Senior Secondary School curriculum. "Energy Technology and the Environment" was included as one of the modules in the Liberal studies curriculum. Given that climate change is also considered one of the most pressing contemporary environmental issues, it seems logical to include it as a topic in Liberal Studies curriculum. However, the curriculum document for Liberal Studies did not explicitly mention climate change as a mandatory topic. Instead, climate change was mentioned as an example of environmental issues that is created by the pollutants generated by use of energy technology. It is also possible to include climate change as an issue addressed through international collaboration. (Curriculum Development Council, 2015) However, as the curriculum documents has such a minimal mention of climate change, students' exposure to this issue depended largely on the school-based decisions of Liberal Studies teachers, resulting in significant variation in students' experiences with this topic.

Starting from 2021, Liberal Studies in the Senior Secondary school curriculum has started

being replaced by the new subject Citizenship and Social Development. The current curriculum document for this new subject was released in 2021. While the document mentioned the topic of sustainable development, neither climate change nor global warming is explicitly mentioned in the latest version of the curriculum document. It is therefore unclear whether climate change will remain a common topic in the new subject curriculum.

2.4.4 Summary from school curriculum

Based on the above analysis of the curriculum documents, it remains unclear whether secondary school students are being adequately educated about the basis of climate change. While students have ample opportunities to learn about the basis of global warming and climate change through science and geography curricula in junior secondary years, exposure to this topic in senior secondary levels has been more restricted to certain elective subjects. Additionally, school-based decisions, along with teachers' decisions, largely determine how students learn about climate change in the common core subject of Liberal Studies. Further studies may shed light on whether students have been adequately informed about climate change before they begin university education.

At present, there is a lack of published data in the literature about Hong Kong students' attainment in learning about climate change when they enter university. For example, a recent study by Cheung, Fok, and Gou (2016) provided some information about how well students performed in environmental studies among graduates from secondary schools in Hong Kong, but climate change was not explicitly mentioned or singled out in their paper. The hidden assumption here is that climate change is considered as just one of the many topics to be examined. However, given that climate change is an urgent and significant global environmental issue, such omissions may be considered problematic.

To gain insights into the outcomes of climate change education in the school curriculum, we can turn to the recent study by Jackson and Pang (2017) mentioned above, which examined the effectiveness of climate change education among local schools and international school students. Their findings indicated that students in the latter group were more aware of local and global issues related to climate change and could articulate different personal actions in response to climate change more clearly. As these two groups of schools use different school curriculum structures, such differences in students' performance may hint at the influence of the curriculum.

However, such studies, including Jackson and Pang (2017), have mainly adopted frameworks traditionally used for education for sustainable development or environmental education by examining students' environmental attitudes, awareness, and behavior towards climate change. However, their discussion of climate change education largely overlooked the emotional implications of climate change education, as highlighted by research in the last decade. Jackson and Pang acknowledged that the use of some established tools in ESD research, such as the Likert-scale in surveys, may be problematic in the Asian context. At the same time, the discussion regarding how students feel about the issue of climate change, particularly the crucial importance of hope in climate change education, remains largely overlooked in the education literature in the local context. As noted earlier, these questions are highly relevant to understanding students' motivation in studies and personal behaviors.

2.5 learning outside formal school curriculum

Climate change is one of the most significant environmental issues that is frequently highlighted in various learning experiences both inside and outside the school curriculum. These learning experiences include extracurricular activities offered by local organizations,

including NGOs. Some of these activities are also provided by the quasi-governmental organization, Environmental Campaign Committee (ECC), which organizes large-scale extracurricular activities for students. A notable example is the Student Environmental Protection Ambassador Scheme, which is organized by ECC and involves the participation of primary and secondary school students. Another example is the Hong Kong Green School Award, which has become a significant platform for facilitating some larger scale students' environmental protection activities. Some of such activities are described by Tsang, Lee, and Gough (2020), with more than 100 local primary and secondary schools participated in the Inter-school Cross-curricular Project Competition on Climate Change in 2016 through participation in the Hong Kong Green School Award. Participation in such events may help to consolidate students' learning about climate change.

However, it is essential to note that participation in extracurricular activities is usually voluntary rather than mandatory. Moreover, as these activities are diverse, not all students can receive the same learning experience from them.

It is also important to acknowledge that formal school subject curricula are not the only sources of information on climate change. In addition to school curricula, educators have access to other sources of information on climate change via the internet. A prime example of such information source is the Hong Kong Observatory which provide high quality and updated information about weather and climate. While some of this information may be challenging for self-learning of secondary school students, educators with extensive knowledge backgrounds should be able to incorporate such materials on local impacts of climate change into their teaching.

In addition to learning experience within campus, learners today are also continuously exposed to information from various media sources. Lastly, information can also come from their families and peers. It remains an area of active research to understand how young people cope with the information on climate change from these various sources (Ojala, 2019, 2021).

2.6 Climate change education in university

The diversity of students' previous learning experiences through the school curriculum can partially contribute to their varying attitudes towards climate change. Within the context of university education, climate change education can take different forms within and outside the curriculum. At the university level, some students may learn about climate change through standalone lectures, while others may have studied one or more semester-long courses focused on different thematic aspects of climate change.

The diversity of possible forms of climate change education learning experience in higher education curricula is highlighted in a recent paper by Molthan-Hill, Worsfold, Nagy, Filho, and Mifsud (2019). They classified initiatives for integrating climate change education into higher education into four categories of ascending sophistication: *piggybacking, mainstreaming, specializing,* and *connecting (transdisciplinary)*. *Piggybacking* involves integrating learning about climate change into existing courses without changing the existing curriculum structure and can be very small scale or piecewise. *Mainstreaming* involves integrating climate change into the existing program structure, making it an essential element of the curriculum structure. *Specializing* involves providing climate change education through specific curricula, aiming to produce graduates with the necessary attributes required to tackle specific concerns brought about by the challenges of climate change. Lastly, *connecting, or*

transdisciplinary refers to offering climate change education as a transdisciplinary learning opportunity, while integrating different perspectives from different disciplines in the process. (Molthan-Hill et al., 2019)

With these possibilities for curriculum integration, it is crucial for each higher education institute to choose suitable modes of delivery for climate change education. Similarly, for undergraduate teacher education programs, it can be argued that climate change education is just one piece of the puzzle in comprehensive pre-service teacher training. The decision to adopt a suitable mode of implementation for climate change education remains a complicated issue for curriculum developers.

Such diversity in learning experiences presents a significant research opportunity, as we can explore the relationship between learning experience and emotions to climate change. Even when such learning activities are not implemented under the thematic focus of climate change, it is probable that learning experiences related to other global environmental issues or ecological sustainability may also affect how young people think and feel about other important issues such as climate change. An example of such exposure is provided by Cheang, So, Zhan, and Tsoi (2017), in which undergraduate students participated in organic farming activities in an eco-garden environment. It would be affirming if any such spill-over effects can be observed from studying students with different learning experiences.

2.7 Influences from teachers in the past

The preceding discussion has explored the various influences of learning experiences and psychological factors on learners. However, this discourse must also include how learners perceive their learning experiences. In addition to the curricular aspects of the experience,

students' perception of how their teachers deliver the learning experience may also be relevant. As we know from Ojala (2015), learners' perceptions of climate change can also be affected by perceived teacher attitudes and communication styles in the past. It is possible that learners attribute different outcomes of their learning to specific teachers in their past. Past studies such as Lombardi & Sinatra (2013) explored the emotions possessed by teachers teaching climate change. Results from this study suggest that emotions of hopelessness, anger and decisiveness are related to plausibility perceptions in teacher, which may affect teachers' attitudes in teaching about climate change. (op. cit.) The extent to which students' perceptions about their learning were affected by their teachers in the past is an issue to be verified.

2.8 Conceptual framework

Upon examining how learning about climate change interacts with learners' emotions and hope, the conceptual framework of this study is presented in Figure 1. The numbers in the figure correspond to the paragraph in this chapter. The focus of attention is to examine the influence of learners' emotions to climate change, represented by the central box in the diagram. The upper half of the diagram depicts factors that contribute to these emotions. It is acknowledged that learners' emotions are significantly affected by their perceptions of climate change, which are shaped by their past learning experiences in climate change education. These experiences include formal learning in secondary school and university curricula, as discussed above.

Figure 1

Conceptual Framework of this Study
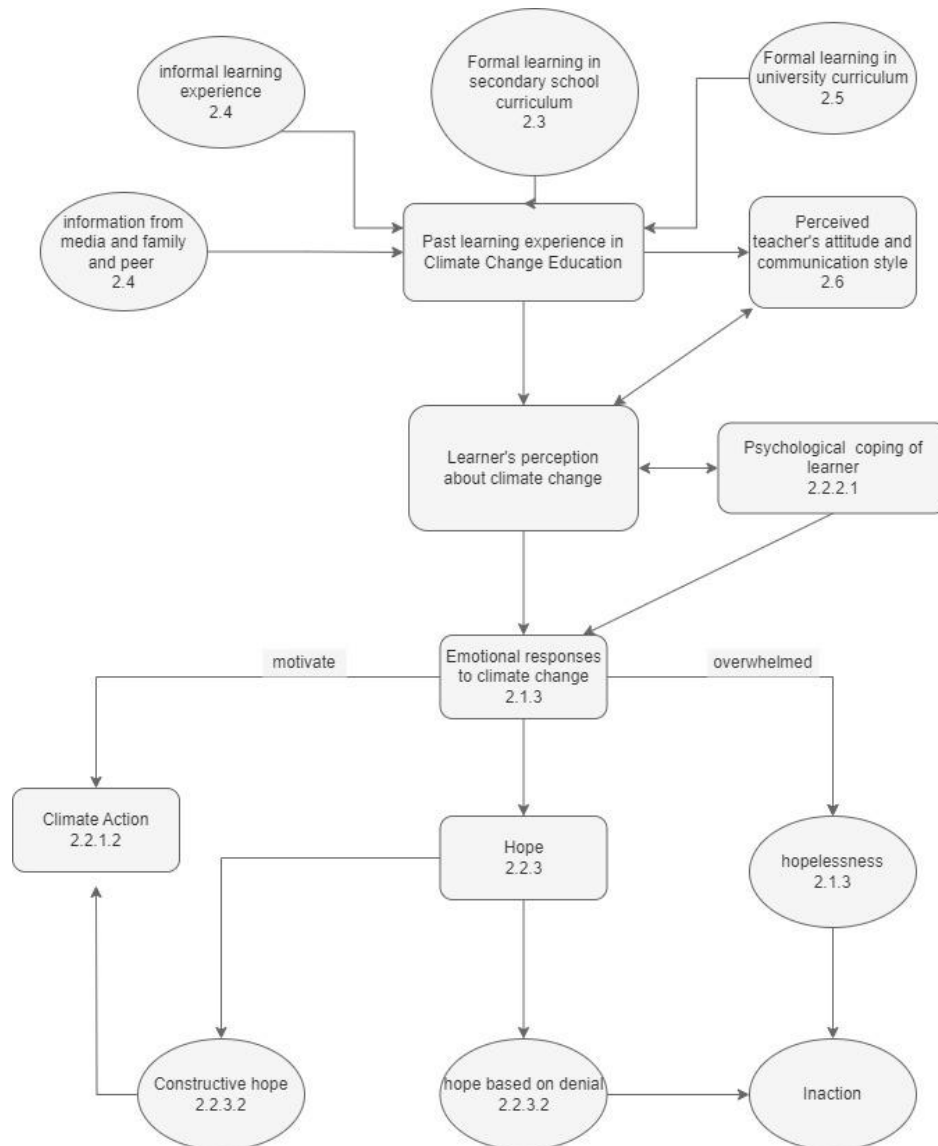
Additionally, past learning experiences in climate change education may also come from outside the curriculum, including informal learning experiences, information from media, family, and peers. These are included in the upper left corner of the map. The box in the upper right corner of the diagram represents perceived teachers' attitudes and communication styles in the past, as indicated by Ojala (2015).

Based on our above discussion about how learners handle the stresses and worries through psychological coping, it is assumed that psychological coping has considerable influence on learners' perception about climate change. At the same time, psychological coping will also affect the learner's emotion to climate change. Both influences are shown as the box and the arrows on the right side of learner's perception in the diagram.

The lower half of the diagram illustrates the influence of emotions to climate change on learners' behaviors. As mentioned previously, some emotions can motivate learners to take action to tackle climate change, it is indicated by the box Climate Action in the diagram. However, some emotions may also demotivate learners from acting in response to climate change. Attention is particularly drawn to learners who may become overwhelmed and experience hopelessness, leading to inaction against climate change, as revealed by the literature discussion above. Therefore, hopelessness is marked in the lower right-hand corner of the diagram.

As previously mentioned, the influence of hope can be two-way. According to Ojala (2015), whether such hope can motivate or demotivate the individual in climate action will determine whether such hope is constructive or based on denial. These are shown by the third branch from the emotions to climate change, in which *constructive hope* contributes to climate action, whereas *hope based on denial* leads to inaction.

2.9 Toward the Research agenda

Prior studies on the topics of hope and emotions in the context of climate change have yielded valuable insights that warrant further investigation. The following section presents an overview of the key ideas and findings that have emerged from the existing literature on this subject matter.

The literature related to the emotional aspects of climate change education highlights two areas of potential research interest. The first area is to investigate the status of climate change education based on the past learning experiences of young people studying in the context of local universities. The second area is to link the local status of climate change education with international discussion. While current studies have provided a good basis for understanding the local situation, they are limited by specific socio-cultural contexts. Ojala (2015) explored students' hope and perception of teaching in the context of Sweden high school, providing a basis for studying students' hope and perception of learning experiences among university students. The psychological coping strategies and hope of university students in a different cultural setting can be examined.

Similarly, since emotions play a pivotal role in climate change action, it is important to explore how a different group of university students responds in more details. The study by Wang et al. (2018) only included samples from a cohort of 94 psychology students in Australia, making it possible to compare the reactions of other groups in the same age from other universities with different socio-cultural backgrounds. Given that university students have diverse backgrounds in climate change-related studies, a more detailed exploration of how different groups of university students feel about climate change can be revealing. It is also relevant to study whether different learning experiences in climate change-related studies can contribute to

different emotions in students. Further studies are also needed to validate the scarcity of emotional connections with climate change as reported in Wang et al. (2018) with other cohorts of university students.

This study has additional significance in the context of teacher education. For pre-service teachers who will be involved in climate change education when they graduate, their perception of climate change will likely have a significant influence on their future students. Emotional awareness in climate change education, as suggested by Ojala (2015), can be integrated into teacher training programs. Research in this area can reveal the nuances of how emotional awareness should be developed.

Given the lack of local studies focusing on teacher education in climate change, data from this aspect should facilitate informed discussions in curriculum planning. By improving our understanding of the influence of emotional factors in the process of climate change education, future educators can be better prepared with the necessary skills and emotional awareness. If climate change education is considered an indispensable part of teacher education, such knowledge will also facilitate better curriculum planning of pre-service teacher education.

Lastly, any innovative attempts in teacher education can potentially have ramifications for education at other levels. This study may provide insights into how climate change education can be improved locally outside of university education.

2.10 Research questions and sub-questions

Based on the literature we have reviewed in this chapter, sub-questions are added to address the first two research questions on emotions and hope about climate change with more nuances and details. For the first research question (RQ1) which is about how students perceived emotionally to climate change, it is necessary to find out which emotions are more commonly reported by students. We also need to know if the observed patterns of these emotions originate from factors related to their personal or educational background. These considerations are addressed by two sub-questions to the first research question.

For the second research question (RQ2) about hope of students to future of climate change, we need to examine whether the students possess *constructive hope* or *hope based on denial*. As we are informed by Ojala (2015) about the possible influence of communication styles of teachers on students' perceptions about climate change, it is also necessary to check for such influence. Apart from such perceived communication styles of teachers, we also need to examine how students describe their past learning experience. As a result, three sub-questions are added to the second research question.

After adding sub-research questions as mentioned in previous paragraph, the following is the full list of research questions of this study.

RQ1: What is the relationship between hope and emotions to climate change among students of Bachelor of Education programme?

RQ1a: What are the most common self-reported emotions of students of Bachelor of Education programme to climate change?

RQ1b: What are the differences, if any, in self-reported emotions among students of Bachelor of Education programme?

RQ1c: Which type of hope is more commonly possessed by students of Bachelor of Education programme to climate change?

RQ1d: In what ways do students' hope in climate change affect their emotions to climate change?

RQ1e: In what ways do students' hope in climate change affect how students perceived communication style of teachers in the past?

RQ2: How do students' hope in climate change affect their perceptions of the future of climate change and their learning experience in the past?

Sub-question 2a (RQ2a):

In what ways students with different hope in climate change describe the future of climate change?

Sub-question 2b (RQ2b):

In what ways students with different hope in climate change describe their learning experience in the past?

Research Question 3 (RQ3):   In what ways are emotions and hope in climate change education being handled by teachers in exemplar lessons in Education University of Hong Kong?

2.11 Summary of this chapter

This chapter provides a comprehensive review of the literature relevant to conceptualizing research on how university students perceive climate change emotionally. The UNESCO document was consulted to illustrate the objectives of climate change education. The review suggests that emotions and hope are highly relevant to how students perceive their learning about climate change and how they respond to the issue. Students have different opportunities to learn about climate change within and outside of the school curriculum, but both emotions and hope have a great influence on their decision to take various climate actions. Current literature suggests that while emotions can motivate climate actions, negative emotions such as helplessness and hopelessness can also lead to inaction among students. Differentiating *constructive hope* and *hope based on denial of climate change* is important, as the former is linked to climate action, while the latter is linked to inaction.

The relevant school subject documents were also examined to assess whether existing school subjects provide sufficient coverage of the topic of climate change. It was observed that the topic is mainly covered in geography curriculum. Within science subjects, climate change is mainly introduced as global warming. Other subjects, including the discontinued Liberal Studies, have also provided opportunities for teachers to teach climate change based on school-based decisions.

In conclusion, we suggest that studying the hope and emotions of university students and future teachers can provide an opportunity for professional discourse on climate change education. It can also provide direction for evidence-based curriculum innovation.

Chapter 3 Research Method

3.1 Overview of the chapter

This chapter presents the research methodology employed in the current study. I start by examining the data collection required for answering the three research questions, arguing why mixed method research is appropriate for this study. The issues that could potentially challenge the validity and reliability of the research are then explained. It is followed by descriptions of the target population of this study. The research instruments that were used to capture the data are then described. Afterward the data analysis process is outlined. The chapter is concluded by how the results of analysis are used to answer the three research questions.

3.2 Mixed method research

As explained in previous chapter, this present study examines the relationship between emotions, hope and learning experience about climate change in a specific context. From an ontological standpoint, inquiry into the "reality" of the emotional aspects of climate change education can be approached in diverse ways. However, all these approaches require data collection in a localized context. The first approach entails collecting empirical evidence to comprehend how the target population perceives their learning experience in climate change education. This involves utilizing quantitative research methods to reveal overarching patterns within the target population through statistical analysis. Alternatively, it can also involve delving into how university students think and converse about climate change by engaging with a more concentrated group of students. Finally, observing the process of how climate change education is implemented in the classroom can also provide valuable insights. Therefore, a mixed-method approach is the optimal framework to integrate all three sources of research data.

The use of both quantitative and qualitative research methods provides a comprehensive understanding of the implementation and effectiveness of climate change education in undergraduate teacher education programs.

Mixed method research is a well-established approach that has gained significant attention in recent years and is recognized as one of the three major types of research, alongside quantitative and qualitative research. Compared to the other two types of research, mixed method research is relatively young and has a history of over three decades. According to Creswell (2014), in mixed-method research, the researcher is required to gather both quantitative and qualitative data, which are then integrated to draw interpretations based on the strength of both sets of data. This approach results in a rich and comprehensive description of reality. Typically, the researcher may use either quantitative or qualitative research methods at one phase of the research and then switch to the other type for the next phase, depending on the research question at hand.

Among the different types of mixed method research, the present study adopted an embedded design, where both quantitative and qualitative data were collected and interpreted together to answer the research questions. The choice of research method for each research question is explained in the following paragraphs.

3.2.1 Online survey

The first research question focuses on studying the relationship between emotions, hope and past learning experience of undergraduate students in the Bachelor of Education program. Such exploration involves multiple factors which can be done via quantitative study using well-structured instruments and statistical analysis of empirical data. The relationship between

emotions and hope with the other factors related to learning experience can then be deduced. For this part of the study, a structured survey developed using established scales from literature on climate change education was used. Using quantitative methods, the extents of the influence and interaction between these factors can also be estimated.

3.2.2 The interview

The second research question explores details about students' hope and also their past learning experience about climate change. To achieve this, it was necessary to study how university students articulate the issue of climate change. However, studying the nuances of emotions and how they related to past learning experiences using only quantitative methods may be insufficient and inappropriate. As discussed in the previous chapter, there were numerous factors that may affect how young people perceived climate change. Therefore, exploring these factors using structured surveys items may impose structures on respondents' perceptions. For example, Likert-scale items commonly used in quantitative studies to measure environmental attitudes may prompt respondents to guess how they should answer the questions, thereby introducing biases into the data.

Given the data required for answering the second research question was less structured, qualitative methods that can address the exploratory nature of the data and its interpretation were more suitable. The researcher approached this research question through collecting data with interviews and writing task. In-depth interviews allowed for a more nuanced understanding of how individuals perceived climate change and its emotional impacts on them. Moreover, it enabled the exploration of how these perceptions were shaped by past learning experiences, personal beliefs, and values.

However, it is important to acknowledge the limitations of using interviews as a major strategy for data collection. The anecdotal data provided by interviewees were primarily subjective and represented only the students' perspective of their learning experience. Additionally, these accounts may misrepresent what was truly happening. If the findings from these interviews are used to make suggestions for curriculum or instruction, it is necessary to consider the perspective of educators. This is the purpose of including the third research question in this study.

3.2.3 Lesson observations

To address the third research question concerning how the emotional aspects of climate change education are being addressed in classrooms, it is necessary to gather data from the implementation stage of climate change education. For this purpose, it is essential to analyse exemplar lessons on climate change.

Specifically, the analysis should facilitate an examination of how different instructional approaches in lessons about climate change may have implications for the emotions and hope of students. Together with the insights gained from the first two research questions, observations of authentic classroom situations provide a basis and context for making suggestions for changes in climate change education.

3.3 Issues of validity

To ensure the rigour of the data collection process, potential sources of threats to the validity of research were identified by the researcher based on the discussion of Maxwell (2012) and Creswell (2014). Three such potential sources of threats to the validity of research were identified by the researcher for this study before data collection commenced. These were the

influence of teacher-student relationships, the short-term influence of recent and single learning experiences, and the interpretation of personal climate actions. There are explained below together with what had been done to minimize such influence.

3.3.1 Teacher-student relationship

In research, the presence of a power relationship between the researcher and the subject is considered problematic for validity. In the case of climate change education, the teacher-student relationship may suggest to the subjects that they should provide responses that are perceived as "desirable" or "correct," rather than giving honest answers based on personal belief.

As a teaching staff member at the university, it was necessary to be particularly mindful of this teacher-student influence during the data collection process. To minimize such influence, several precautionary measures were taken in this research. These measures are described in the following three paragraphs.

To minimize conflicts caused by the dual role of teacher and researcher, no students were recruited for the study when they were currently enrolled in courses taught by the researcher. In cases where students recalled any previous learning experience delivered by the researcher, such responses were noted in the record and declared accordingly in the analysis. This allowed for noting the probable presence of teacher influence during the interview.

When the research was introduced to students, it was explicitly communicated in both verbal and written forms that the writing tasks and interviews were not part of any coursework assignments in which they were currently enrolled. This presumably reduced the pressure on the subjects to provide "positive" or "correct" responses during interviews for academic reasons.

To alleviate interviewees' concerns about the adverse consequences of expressing their genuine views, the identities of the interviewees were kept strictly confidential by removing any identifiable information from the transcripts to preserve the anonymity of the interviewees.

3.3.2 Short-term versus long-term influence

A second concern about validity pertained to the effect of time elapsed on the perceived influence of past learning experiences. As the study depends on the subjects' disclosure of their thoughts and feelings about the impacts of their learning experiences, it is important to note that our memories of past experiences tend to fade over time. Details about learning experiences from the distant past may not be very accurate.

While short-term interventions in various forms of educational activities can be meaningful, the effects of such interventions may be temporary and may appear to be more significant for students. As the study aimed to explore the effects of past learning experiences related to how young adults perceived climate change, it is necessary to distinguish the effects of short-term influence from more long-lasting ones. It is, therefore, crucial to collect information about the timing of these learning experiences so that such influences can be noted in data analysis.

3.3.3 Interpretation of personal climate actions

Another concern regarding validity pertained to how the subjects interpreted their personal actions in relation to the issue of climate change. While personal actions toward climate change are considered important and desirable outcomes in climate change education, questions about what actions should be taken are not trivial. Such questions are arguably linked to personal knowledge and how these actions are interpreted.

Consequently, it is essential to exercise caution during interviews to avoid the inadvertent suggestion or association of specific climate actions to the interviewees. The meanings of climate actions should be presented by the interviewees themselves rather than by the researcher. Therefore, a conscientious decision was made not to include a comprehensive list of specific climate actions in the online survey. Instead, the interview process was employed to capture personal interpretations of the meanings and importance of climate actions. This approach enabled the interviewees to provide detailed elaboration on what climate actions they considered significant and whether they were committed to such courses of action. The analysis of their responses facilitates a greater understanding of their perspectives on various climate actions and the origins of these ideas.

3.4 Target population

The target population of the study was undergraduate students pursuing the Bachelor of Education (BEd) programme at the Education University of Hong Kong. As elaborated in the preceding chapter, this target group was selected due to their dual identity as prospective teachers and university students. Consequently, the perceptions of this group regarding climate change had the potential to offer insights for both higher education and teacher education.

3.4.1 Sampling of online survey

Ninety-three undergraduate students in Bachelor of Education programme from the Education University of Hong Kong were recruited to complete the online survey. To examine the impact of their educational backgrounds on their perception of climate change, students with varied major subjects of study were recruited. As students typically chose their major subjects of study based on their previous academic achievements in pre-university study, this recruitment

process had captured a reasonable diversity in their pre-university educational backgrounds and learning experience.

The sampling strategy in this study was complicated by the disruptions caused by the COVID-19 pandemic. Ideally, to ensure more representative data, stratified sampling strategies should be adopted to collect survey data. However, collecting survey data through online questionnaires in this study was particularly challenging due to the low response rate for voluntary online questionnaires. To illustrate, consider the student evaluation of teaching (SET) questionnaires, which are typically administrated at the end of a course in face-to-face teaching settings and usually obtain reasonably high return rates. However, in an online teaching environment, the return rate of SET surveys can be as low as 10% despite encouragement from the teachers concerned. Therefore, it is not surprising that the return rate of online questionnaires for a voluntary online survey was very low.   Pragmatic concerns especially the difficulties to recruit survey respondents also led to the decision that no pilot test of the online survey was conducted for current study.

To compensate for the low return rate, invitations to participate in the research were sent to as many courses under the Bachelor of Education programme as practically possible. The researcher solicited help from teachers who were teaching any courses under the programme, and the link to the online questionnaire was made available to the students, along with background information about the research and a consent form to join the study.

To ensure that the recruited students had more diversified learning backgrounds, they were recruited from classes with different major subjects of study. The goal was to obtain a reasonably diversified sample from the whole population of undergraduate students in the

Bachelor of Education program. Such diversity should also allow for comparisons to be drawn between different major subjects using statistical methods.

3.4.2 Selection of the interviewees

For the semi-structured interviews, the initial goal was to invite 10-15% of the respondents who had responded to the online survey, as described previously. Out of the 93 respondents of online survey, 11 expressed their willingness to participate in an interview. They were invited to online interviews via email and phone calls. One of the interviewees encountered technical difficulties and scheduling conflicts, which made it difficult to arrange an online interview. Ultimately, ten online interviews were successfully conducted.

Prior to the interviews, the responses of the interviewees from the survey were reviewed to provide an overall profile for the researcher. Due to concerns about the pandemic situation in 2021, the interviews were conducted via the online platform Zoom. The interviews were audio-recorded and transcribed for further analysis.

3.5 Data collection

In the following section, the design of the data collection process was described. It was followed by the details of each instrument of data collection.

3.5.1 Two phased design of data collection

The data collection in this study was conducted in the following two phases. The first phase mainly adopted a quantitative design, while the second phase was qualitative.

In the first phase, data were collected via an online survey. This was followed by an initial

analysis of the survey data collected, which allowed for the identification of subjects for interview. The second phase of data collection comprised two distinct activities for qualitative research, namely, semi-structured interviews and classroom observations.

Semi-structured interviews were conducted with the shortlisted subjects identified from the initial data analysis of the survey. These interviews aimed to yield more detailed information about possible linkages between emotions and previous learning experiences in climate change.

After the semi-structured interviews were concluded, two classroom observation sessions were arranged with teachers who were engaged in climate change education at the Education University of Hong Kong. These lessons were chosen based on the criteria that they were directly relevant to climate change education and attended by students in the Bachelor of Education program at EDUHK. For each lesson, video recordings of the selected lessons were available from a previous cohort prior to 2021. These recordings were used in subsequent analyses.

Further details about the interviews and classroom observations are described in the instrument section.

3.5.2 Time of data collection

Data collection for this research commenced in early 2021. However, the data collection process was significantly complicated by the COVID-19 pandemic situation that arose during this year. To minimize the spread of the coronavirus infection in the community, face-to-face teaching on campus was largely suspended and replaced by online teaching in local universities for most of the months in 2021. Consequently, to avoid further delays in the data collection

process, most of the data collection activities had to be conducted online. Such a mode of data collection had considerable negative impacts on the data collection process, including a lower response rate to the survey and the need to adapt the data collection tools to an online environment. The other effects of these changes on the research are discussed in Chapter Five.

The research design of this study is summarized diagrammatically in Figure 2.

Figure 2
Research Design of this Study
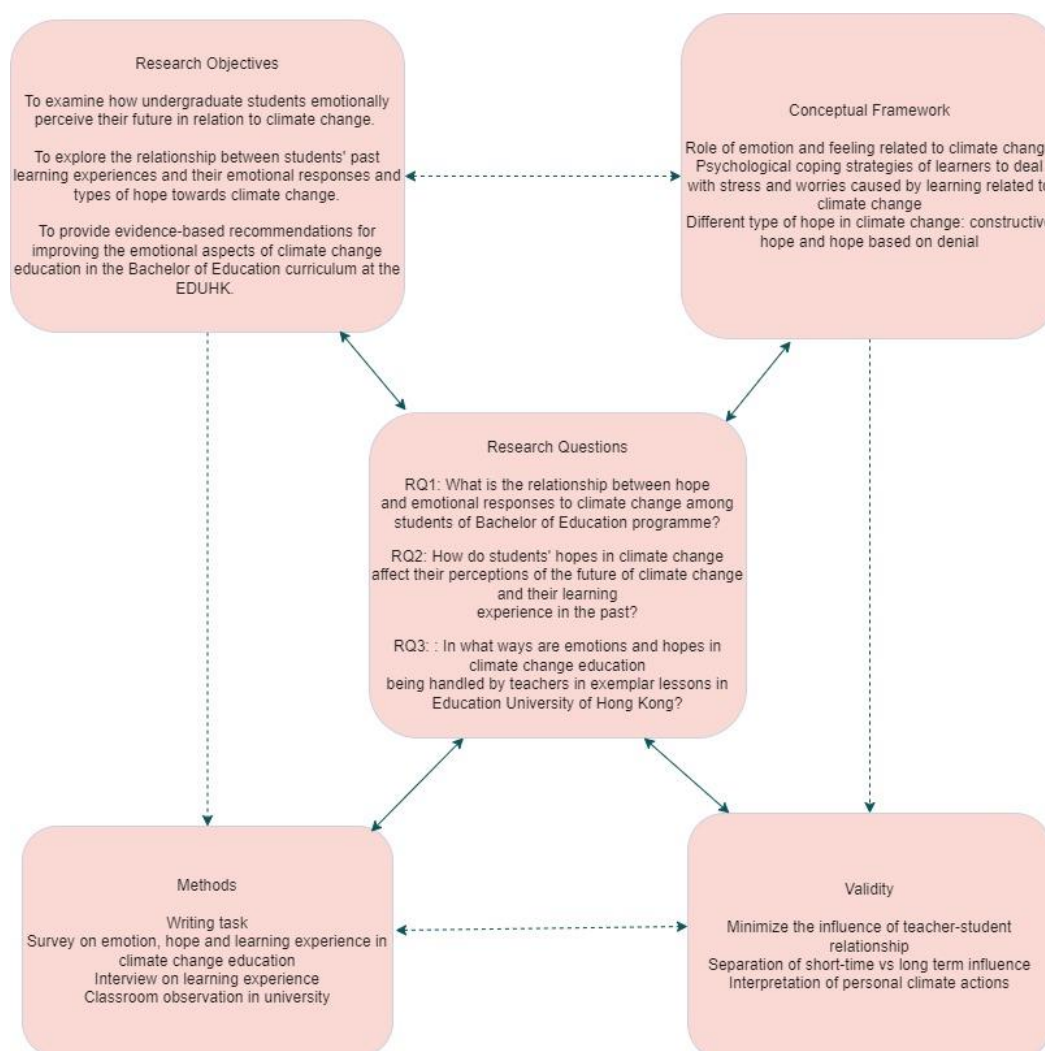
3.5.3 The Research Instruments

The following section described the four instruments for collecting data in this study. The detailed questions for each part are also included in Appendix I to Appendix III.

3.5.3.1 The writing task

The first instrument for data collection was a writing task based on the study design of Wang et al. (2018). This task provided evidence to answer the second research question (RQ2), where subjects were invited to provide written responses to the question "How do you feel about climate change?" This question was the same question used in the three studies reported in the same paper by Wang's team in 2018 and in the project "Is It How You Feel" by Duggan (2015) (Wang et al., 2018). While the wordings of this writing task were simple, this was focused on the emotions towards climate change. It also provided a basis for comparing emotional responses between university students in Hong Kong with other international studies. The writing task included instructions for the subjects to focus on their feelings and emotions, and respondents were given the option to provide their responses in either English or Chinese to allow for easier articulation of their feelings.

This writing task was included in the first round of online surveys conducted in early 2021. However, it was later discovered that the online survey took too long to complete with the writing task included, which adversely affected the completion rate of the online survey. As a result, the writing task was not included in the second round of distribution of online surveys. Instead, this question from the writing task was subsequently included in a later stage of data collection as an interview question.

Nevertheless, despite these complications, a small batch of 47 scripts of writing tasks were

collected in the process, which corresponded to about half of the surveyed students. As this small batch of data also captured how the participants felt about climate change, it was analysed and compared with other qualitative data collected in the interview, as explained later in this section.

3.5.3.2 Online survey

The second instrument of data collection was an online survey, which was designed to capture the quantitative data for answering the first research question (RQ1) about emotions and hope about climate change. This part took the form of quantitative research with items adopted from Ojala's (2015, 2019) research on hope and Wang's research on emotions (Wang et al., 2018). As mentioned in literature review, Ojala explored the ideas of hope and differentiate between *constructive hope* and *hope based on denial* (Ojala 2015, 2019). The latter of the two, *hope based on denial* is highly relevant to climate change education in higher education context. These papers also explored the students' perceived teachers' communication style, which is useful for exploring students' past learning experience in climate change education. On the other hand, the comprehensive checklist of emotions used by Wang's study in 2018 provides a basis for comparisons with other international studies (Wang et al., 2018). Both selected scales are considered natural and suitable choices based on literature reviewed.

More specifically, the following paragraphs summarize the items that were included in the online questionnaire. These items are also listed in Table 3.1 for reference.

Table 3.1

Summary of Questions in the Online Survey

Instrument	Data (related items)	Corresponding Research Question
Online survey	Emotion profile (Q1)	RQ1a, RQ1b
	Hope scale (Q2)	RQ1c, RQ1d
	Background Information (Q3)	RQ1b
	Teachers' outlook on teaching climate change (Q4, Q5)	RQ1e, RQ2

Q1 Feelings and emotions towards climate change

The first question (Q1) in the questionnaire aimed to capture the subjects' feelings and emotions towards climate change using twenty-one 5-point Likert-scale items based on the study by Wang's paper (Wang et al., 2018). The first 19 emotions (Q1a-1s) listed were the same as those used in the previous study. The two remaining emotions, *joyful* and *bored* (Q1t-1u), were present in the study by Leviston et al. (2014), which was referenced by Wang's paper. (op.cit.). The full list of emotions used in this part is shown in Table 3.2, where the 21 emotions are categorized into four groups: positive emotions, negative emotions with possible implications of inaction, negative emotions with possible implications on action, and negative emotions with no clear implications on action. The grouping of these emotions was based on the literature discussion from the previous chapter. Given that the respondents may have difficulties with the English terminology for emotions, Chinese translations of these terms were also provided in the survey. These groupings of emotions are consulted in the data analysis process when we explore their implications for climate action.

Table 3.2

Full Listing of 21 Emotions Used in Q1 of Survey of this Study (Grouping by Author)

E1: Positive emotions	E2: Negative emotions with possible implications of inaction	E3: Negative emotions with possible implications on action	E4: Negative emotions with no clear implications on action
Determined	apathy	upset	pessimistic
fascinated	powerless	sad	ashamed
hopeful	overwhelmed	concerned	frustrated
joyful	discouraged	worried	surprised disgusted
	confused	fearful	
	bored	angry	

Q2 Hope scale

The second question in the survey (Q2) aimed to capture data about the types of hope among students using the *hope scale* with twelve 6-point Likert-scale items from Ojala (2015). As discussed earlier, the data collected facilitated the analysis of whether the hope expressed by the students was dominated by *constructive hope* or *hope based on denial of climate change*. The twelve items were listed as Q2a-2l, where eight items measured *constructive hope* and the remaining four items (2b, 2d, 2h, and 2l) targeted *hope based on denial of climate change*. One of these items (2l) was originally geographically specific to the weather in Sweden ("Because I think it is a good thing that the summers in Sweden are getting warmer as a result of climate change"). However, as this item was not relevant to the study context, it was changed to a similar and comparable statement about local weather for Hong Kong: "Because I think it is a good thing that the winters in Hong Kong are getting warmer as a result of climate change."

Q3 Background information

The third question in the survey (Q3) was designed to collect background information about the respondents. These items included gender, year, and major of undergraduate study. The subjects were also asked to indicate whether they had learned about climate change in any courses at the university level. This allowed for a comparison between subjects with relevant learning experience at the university level and those without such experience. Collectively, these four questions represent four possible factors that can be explored in statistical analysis.

Q4, Q5 Teachers' outlook when teaching climate change

The subsequent two questions in the survey (Q4, Q5) aimed to capture the subjects' perceptions of the attitudes of secondary school teachers and university educators when teaching climate change. The teachers' outlook when teaching climate change was captured by two groups of eight items in Likert-scale as adopted from Ojala (2015, p. 139). The first group of eight items (4a-h) related to the subjects' previous learning experiences in secondary school, while the second group of eight items (5a-h) pertained to their university education.

It is important to note that the students' responses in this part were not directed at individual teachers. Rather, these two groups of questions probed the subjects' perception of their past learning experiences about how their teachers delivered content on societal and environmental issues in general. As the questions aimed to elicit perceived teachers' attitudes in communicating about societal and environmental issues, the subjects' responses were not necessarily restricted to the issue of climate change.

The eight statements of the scale were divided into two groups. The first five statements (4a to 4e and 5a to 5e) were positive descriptions about the perceived teachers' attitudes in

communication. The remaining three statements (4f to 4h and 5f to 5h) were negative descriptions about the perceived teachers' attitudes. The responses to these statements, combined together, represented how the subjects perceived their learning experiences in environmental issues, including climate change.

The final part of the questionnaire included a question asking if the respondent was willing to participate in an interview. Those who expressed willingness to participate were asked to provide their contact information.

3.5.3.3 The interview questions

The third instrument utilized in this study was the semi-structured interview. The researcher followed Kvale (2007) on general advice on planning interview questions and on ethical discussion about interview study. The interview questions were designed to gather more detailed information about the subjects' hope and past learning experiences regarding climate change. The aim was to explore the possible linkages between learning experience, emotions, and hope towards climate change. If such linkages existed, the researcher also probed further to explore the nature of these linkages. The focus of the interviews was not on evaluating the effectiveness of past learning experiences but rather on the learners' perception of their learning experiences.

A summary of the interview questions is shown in Table 3.3 The full list of interview questions with Chinese translations is also shown in Appendix III.

Table 3.3

Summary of Interview Questions

Part A:	Personal views about climate change
(0)	their feelings about climate change.
(i)	Their descriptions about the local future regarding climate change and how they feel about it.
(ii)	Their descriptions about the global future regarding climate change and how they feel about it.
(iii)	Do the interviewees think the problems caused by climate change will be solved in the future? If yes, what do they think will happen?
(iv)	Their perceived personal role in tackling climate change.
(v)	Their personal actions in response to climate change and how they feel about these climate actions.
Part B:	Learning experience in climate change
(vi)	their previous learning experience about climate change before university education.
(vii)	which of such learning experiences about climate change do they consider most memorable or impactful to them, with elaboration on details on the learning process.
(viii)	their previous learning about climate change in university study.
(ix)	which of such learning experiences about climate change do they consider most memorable or impactful to them, with elaboration on details on the learning process.
(x)	their expectation of climate change education in university.
(xi)	Aside from formal school curriculum in secondary school and university, do the interviewees have other sources to learn about climate change? If yes, then what are these? Ask for details of the experience. How do they feel about these learning experiences?

The current interview questions were arranged into two halves. Part A of the interview dealt with their personal views about climate change. Part B of the interview dealt with their previous learning experience related to climate change. The corresponding research questions for these questions are shown in Table 3.3a.

Table 3.3a

Corresponding Research Questions for each Interview Question

Instrument	Data (related items)	Corresponding Research Question
Interview	Part A	
	Feeling (0)	RQ2a
	Future (i), (ii)	RQ2a
	Pathway thinking (iii)	RQ2a
	Personal role (iv)	RQ2a
	Personal action (v)	RQ2a
	Part B	
	Learning experience (vi, vii,viii, ix)	RQ2b
	Expectation (x)	RQ2b
	Other experience (xi)	RQ2b

Part A: Personal view on climate change

In the first half and Part A of the interview, interviewees were asked to disclose their personal views about climate change (0-v).

The first question (0) aimed to capture the interviewees' feelings about climate change, corresponding to the writing task. The subsequent two interview questions (i) and (ii) probed the interviewees' personal views on local and global futures, along with their feelings about the

current situation of climate change in both local and global contexts.

The following two questions probed for more detailed information about the type of hope possessed by the interviewees. The third question (iii) pertained to *pathway thinking* of hope on climate change, followed by a question (iv) about their personal role in climate change, corresponding to whether the interviewees viewed themselves as agents of change. Both *pathway thinking* and *agency* are considered two defining characteristics of hope (Petersen & Barnes, 2020; Snyder, 2002). The subsequent question (v) was about their personal climate actions and their feelings about such actions.

Part B: Learning experience about climate change

The second part and Part B of the interview focused on the interviewees' previous learning experiences about climate change. The subsequent four questions (vi-ix) probed for details of their previous learning experiences on climate change. This was followed by a question (x) about their expectations of climate change education in universities.

The final interview question (xi) was included to gather data about other learning experiences related to climate change, such as extracurricular activities or other nonformal learning experiences. It may also include influences from sources such as media and peers. Including this question in the interview allowed for exploration of how the interviewees considered such influences aside from the experiences identified above in the interview.

To ensure sufficient depth and detail in the interview data, each interview session lasted approximately 30 to 45 minutes. The audio recordings of the interviews were then transcribed for further analysis.

During the semi-structured interviews, probing and follow-up questions were utilized when necessary. Probing questions were specifically employed when the initial response from an interviewee did not provide a clear answer to the question asked. For instance, when interviewees were unable to provide descriptions of their feelings when explicitly asked about them or when their responses were not clear or contained vague information that needed further clarification. An example of the latter is when an interviewee cited a friend as the source of information about climate change. In such cases, it was important to obtain more details about the context of the past events.

Given that the focus of the current research is on the interviewees' perceptions of climate change, it was crucial to avoid suggesting ideas related to the topic during questioning. It was especially important to avoid presenting too many hints to interviewees that may influence their perceptions of climate change. For instance, while it was conceivable that the interviewees' attitudes toward climate change may be related to their attitudes toward other environmental issues, it was not appropriate to suggest to the interviewees that there should be direct linkages between the two. Similarly, interviewees should be encouraged to state their own sources of information, as it is possible that they learn about climate change from sources other than academic studies.

Given that the current research focused on emotional aspects, the researcher also asked probing and follow-up questions about any mentions of emotions and hope. Moreover, when observable cues or hints were detected from the interviewees that they were displaying specific emotions, the researcher probed for more details.

3.5.3.4 Lesson observations

The fourth instrument for data collection utilized in this study was classroom observation. These unobtrusive observation sessions were conducted to collect data for the third research question (RQ3) on how emotions and hope toward climate change were being handled in classroom situations. The purpose was to observe whether teachers noticed the emotional aspects of climate change education and to determine if any details of the lessons were relevant to our discussion of emotional aspects and hope in climate change education.

As the climate change education experience of the subjects occurred in the past, the purpose of these classroom observation sessions was not to validate the specific claims made by individual interviewees about their learning experiences. Instead, the purpose was to collect data to study how emotional aspects of climate change education were being handled in some exemplar lessons from different curricular contexts. Two separate exemplar lessons of climate change education were included in the data collection for this part of the study in mid and late 2021. These observation sessions provided necessary references for interpreting interview data from university students.

The contingency checklist adopted for classroom observation is shown in Table 3.4. The items were compiled by the researcher based on reference to Ojala's study on students' *perception of teachers' communication style and future orientation* (Ojala, 2015), which was adopted in the online survey of the current research. While survey items in Ojala (2015) described how students perceived teachers' communication styles, corresponding items on current checklist in table 3.4 were expressed in terms of teacher's actions and pedagogical decisions. The idea of pathway thinking and agency on current checklist are based on Petersen and Barnes (2020), who discussed changes in curriculum and pedagogy at the university level. As the former study

on students' perception was already included in the online survey (as Q4 and Q5), it was possible to draw comparisons between students' perceptions and actual classroom situations by using similar items for classroom observation. This checklist is otherwise not used in previous studies. A further exploration of validating this coding scheme can be the subject of further research.

For each classroom observation session, the observation data on the checklists were recorded together with background information about the lessons. Curriculum documents were also consulted and analysed for any relevant connections to emotional aspects of climate change education. As both lessons were recorded, it was possible to watch the same lessons repeatedly to analyse the video in further detail. More details of the lessons are presented in the next chapter.

In addition to the codes from the checklists, the researcher also made additional field notes about the teaching and learning process. These notes highlighted issues and events that were relevant to emotions and hope as identified previously. Examples include pedagogical designs, classroom interactions, and teacher questions. Other events or details that did not match existing items on the checklists were also recorded for further analysis.

Table 3.4

Contingent Checklist for Classroom Observation

Part A: Coding schemes for teaching content
Future global outlook of climate change

G1	Climate change as event in distant future
G2	Climate change as an event in the near future
G3	Abstract descriptions of impacts of climate change
G4	Concrete descriptions of the impacts of climate change at the global level

G5   Concrete descriptions of the impacts of climate change at the local level

G6   Concrete descriptions of impacts of climate change in specific places in the world

Pathway for resolving climate change

P1   Examples of international collaboration

P2   Examples of scientific/technological solutions

P3   Examples of change of practice in society

P4   Example of change of awareness of culture or society

Actions

A1   Personal actions related to climate change

A2   Personal actions not directly related to climate change

A3   Participation in collective actions in society to address climate change

Personal role in climate change

R1   As individual/citizen

R2   As global citizen

R3   As future teacher/educator

R4   As leader/agent of change

Part B Coding scheme for observations about the teaching process

Questioning

Q1 Teacher asks thought-provoking questions about societal and environmental issues.

Q2 Teacher asks students to express their views about societal and environmental issues.

Feeling and *Emotions*

F1 Teacher asks questions about feelings and emotions experienced by students in the face of climate change.

F2 Teacher presents as optimistic while talking about climate change.

F3 Teacher presents a negative and gloomy picture of the future when talking about societal and environmental issues.

F4 In regard to societal and environmental issues, teachers focus primarily on all the terrible things that are happening in the world.

F5 Teacher makes deliberate attempts to balance the negative messages with significant coverage of positive messages regarding the future of climate change.

F6 Teacher indicates that he is aware of the emotional implications of climate change messages.

Agency thinking	

AT1 Teacher describes his/her personal engagement in tackling climate change.

AT2 Teacher refers to students as young people who can contribute to alleviating various societal and environmental problems.

AT3 Teachers encourage students to make personal plans for climate action.

AT4 Teachers encourage students to join collective actions for climate action.

Pathway thinking	

T1 Teacher talks about societal and environmental problems in the classroom while indicating possible ways to solve those problems in the future.

T2 Teacher describes why climate change is unlikely to be resolved or "unsolvable" even when a solution is suggested by the teacher/student to tackle it.

T3 Teacher talks about why climate change is unlikely to be resolved even with solution is being suggested by scientists/government to tackle it.

With the instruments for data collection introduced, the next section outlines the process of data analysis.

3.6 Data analysis

This section outlines the methods that were used to analyse the data collected and how they were used to answer the three research questions posed. A summary of the data analysis methods is provided in Table 3.5 and is further elaborated below.

3.6.1 Analysis of data from the writing task

The written responses from the writing task were analysed with thematic coding to categorize the responses, following the method proposed by Gibbs (2007). The initial coding scheme focused on the themes of different feelings or emotions expressed in the writing. Given that the question of this writing task was similar to the first question in the interview, further analysis of the responses from the writing task were analysed together with the interview data to allow comparison.

Table 3.5

Summary of Data Analysis

Instrument	Data (related items)	Corresponding Research Question	Analysis method
Writing task	Written responses	RQ2	Thematic coding of scripts
Online survey	Emotion profile (Q1)	RQ1a, RQ1b	Statistical tests for significant differences
	Hope scale (Q2)	RQ1c, RQ1d	
	Education Background (Q3)	RQ1b	
	Teachers' outlook on teaching climate change (Q4, Q5)	RQ1e, RQ2	
Interview	Interview scripts		Thematic coding of scripts
	Feeling (0)	RQ2a	
	Future (i), (ii)	RQ2a	
	Pathway thinking (iii)	RQ2a	
	Personal role (iv)	RQ2a	
	Personal action (v)	RQ2a	
	Learning experience (vi, vii,viii, ix)	RQ2b	
	Expectation (x)	RQ2b	
	Other experience (xi)	RQ2b	
Classroom observation	Observation checklist Field notes	RQ3	Summary distribution of items on checklists, contingent categorization of field notes.

3.6.2 Analysis of survey data

The quantitative data collected from the survey was analysed using SPSS, a statistical software program designed for analysing data. Statistical tests including t-tests and one-way ANOVA were used to explore whether differences in the experiences of climate change education or educational backgrounds can lead to different perceptions about climate change. Factors explored included the subjects' gender, current year of study, areas of major study, and whether they had studied climate change in any course in university. Such data was provided by Q3, Q4, and Q5 of the survey. The scores in hope scale were compared for each of these groupings to determine if there were significant differences among them.

Regarding the questions on feelings and emotions towards climate change in the survey (2a-2s), the data was analysed to create emotional profiles of the subjects. The patterns of these emotional profiles were examined to determine whether they fall into distinct and identifiable types of emotional profiles. The numbers of individuals in each type of profile are compared, and notes from the coding of the writing task and interviews are consulted for possible explanations of the distribution of different emotions.

Regarding data on hope about the future of climate change, the types of hope possessed by the subjects were analysed using the summary statistics of the hope scale from Q2 of the survey, which provided an overview of all the subjects. The type of hope possessed by the subjects were determined by the subscale of *constructive hope* and *hope based on denial*.

Comparison of students with different types of hope can be achieved by grouping students according to the scores of the two hope subscales. Students can be divided into multiple groups with different combinations of hope, allowing for comparisons using statistical tests. This

approach enables us to compare emotions and perceived teachers' communication styles in the past.

To further assess the possible contribution of learning experiences on the emotions and hope of the subjects, one-way ANOVA was conducted on the emotions and hope scales versus the education background information, including major subjects and year of study.

3.6.3 Analysis of interview data

For the interviews, the responses were scripted and analysed by thematic coding using NVivo 12. An initial coding scheme is included in Table 3.6 for reference. The initial coding scheme focused on themes related to different feelings, emotions, and identities. Codes for fine distinctions emerged as the analysis proceeded. For example, even when different codes were assigned to different types of emotions about climate change and those about the learning process, specific emotions such as sadness were identified and coded when they were mentioned in the interview.

Table 3.6

Initial Coding Scheme of Interviews

Code	Descriptions
Emotion	positive/negative emotion about climate change
	neutral/lack of emotion about climate change
	positive/negative emotion about learning experiences

Table 3.6 (cont.)

Future global outlook of climate change	Climate change as event in distant future
	Climate change as event in near future
	Concrete descriptions of the impacts of climate change
	Abstract descriptions of impacts of climate change
Future local outlook of climate change	Climate change as event in distant future
	Climate change as event in near future
	Concrete descriptions of the impacts of climate change
	Abstract descriptions of impacts of climate change
Learning experience about climate change	types of learning activities
	topics or knowledge gained
	emotions to climate change
	emotions to the learning process
	other descriptions of the learning experience
Sources of information about climate change	Learning from subject curriculum
	Learning from teachers/educators
	Information from extracurricular activities
	Information from self-study
	Information from peers
	Information from media/social media
	Information from other sources
Most memorable learning experience about climate change	learning experience in curriculum before university
	learning experience in curriculum within university
	Other learning experiences on campus
Actions	Personal actions related to climate change
	Personal actions not directly related to climate change
	Any form of collective action
Emotion about personal action	Positive emotion about personal action
	Negative emotion about personal action
	Lack of emotion/Neutral emotion about personal action

Table 3.6 (cont.)

Hope about climate change	Hope link to events with details
	Hope link to abstract ideology
	Hope link to denial of problem
	Hope link to futuristic time frame
Pathway for resolving climate change	mention international collaboration
	mention scientific/technological solution
	mention change of practice in society
	mention change of awareness of cultural or society
Personal role in climate change	As individual/citizen
	As future teacher/educator
	As leader/agent of change

For the interview questions (vi-ix) about the most memorable or impactful learning experience in climate change, coding of this part was focused on their descriptions of these episodes of learning experience, which include types of learning activities, topics or knowledge gained, emotions to climate change or emotions to the learning process, and other descriptions of the learning experience as perceived by the interviewees. Any responses from the interviewees with explicit linkages to hope or emotions were also marked in scripts and coded. Similar coding were also applied to the last question about other learning experiences (xi).

3.6.4 Triangulation of students' data

To validate the findings of each part of this research, comparisons can be drawn between the data from different sources. In doing so, triangulation of data was used as a validation strategy (Flick, 2004).

Data from the analysis of interviews can be used to triangulate the observations from the survey and writing task. These data are primarily presented as examples of the relationship between learning experiences and emotional aspects.

Specifically, the first question (o) from the interview, which asks about the interviewee's feelings regarding climate change, is essentially equivalent to the writing task. A comparison of the responses from these two parts can be made based on the analysis of the thematic codes produced. Both can also be compared with the survey questions (Q1) on the profile of reported emotions about climate change.

Triangulation between survey data (Q2) and interview data (question Ai, Aii) is also possible about the two types of hope towards climate change. Descriptions of how students think about the future of climate change in local and global contexts are compared to provide a more reliable representation of students' hope about climate change.

3.6.5 Analysis of classroom observation data

The purpose of analysing the classroom observation is to identify evidence of emotional aspects of the lesson. The checklist shown in Table 4 were used to summarize the observations, and background information about each lesson from field notes and other pedagogical documents were recorded. Examples of pedagogical designs of the lesson, topics or knowledge being introduced, and types of teaching materials used were included.

The summary statistics of the observations provide an overview of the instances in which emotional aspects were addressed in the lessons, such as when the teacher described the severity of climate change problems using different descriptions about the future or uses analogies or metaphors to convey the ideas of how climate change will affect humanity in the future. In such instances, it is relevant to check how the emotional implications were addressed by the teachers.

The field notes recorded during the lesson observation, together with the themes identified from the interviews, informed further analysis of the lesson videos. The proportion of the lesson dedicated to different aspects of climate change education and the types of hope linked to different contents may be analysed. The coding scheme and checklist developed from earlier analysis should allow for highlighting examples from the lesson.

The coding scheme and checklist thus developed can also be adopted for the analysis of other lessons.

3.6.6 Overall data analysis

With the data analysis conducted as presented in the previous section, it is then possible to draw some overall conclusions about the current situation of climate change education in universities. For the first two research questions, we are interested to see if there is evidence that emotions and hope about climate change were affected by previous learning experience. We can then have a more general picture of how students emotionally perceive climate change.

The following section explains how the data analysis above can contribute to answering the three research questions.

3.6.6.1 Relationship between hope and climate actions

To explore possible links between different types of hope and climate actions, we examined the responses from the hope scale in the survey and the responses to interview questions (question v). During this analysis, we examined how the subjects interpreted the meaning of personal climate actions. Together with how they perceived the local and global impacts of climate change, these details confirmed their hope about the future of climate change. As

described in the previous chapter, Ojala (2015) suggests that subjects with a constructive hopeful attitude are likely to engage in concrete climate actions, while the opposite is true for subjects with *hope based on denial of climate change*. We compared the subjects' scores on the hope scale in the survey with their interview responses on personal action to confirm whether such linkages were valid.

3.6.6.2 Relationship between emotions, hope and learning experience

The examination of the relationship between emotions and hope is a crucial aspect in understanding how to describe and predict student learning behaviors in climate change education. The literature review in chapter two has identified two non-competing theories that explain the emotions of students to learning experiences in climate change. The first theory suggests that emotions can either motivate or demotivate students' climate change actions. This approach posits that certain emotions would be expected to be linked with the presence or absence of climate change actions. For instance, Wang's team found that strongly negative emotions were associated with less engagement in climate change actions (Wang et al., 2018). Moreover, it is expected that students with exceptional emotional investment would be either extra motivated or demotivated in climate actions.

The second theory, the psychological distancing theory by Troupe (2010), posits that respondents are likely to show less emotional connections and fewer responsive actions when they consider climate change to be a distant issue. In contrast, respondents are expected to be more emotionally invested when they consider climate change to be personally relevant. The examination of how respondents describe the relationship between climate change and themselves can provide hints about psychological distances.

The data analysis of the survey and interview scripts can determine which of these two theories better describes the current situation of the population of university students. Specific emotions identified in the survey and interviews can also provide evidence of whether students were emotionally invested or distancing themselves emotionally from the issue of climate change.

It is believed that the two theories mentioned above about emotions and climate actions suggest different directions for future curriculum development from the perspective of curricular design. If emotional investment is crucial for climate actions among this group of undergraduate students, the focus of curricular development may be on providing more opportunities for emotionally engaging learning activities. Alternatively, if psychological distance is the determining factor among the students, the focus of curriculum development may be on making learning in climate change more relevant to the learners, thereby shortening the psychological distance.

3.7 Findings

By integrating the results of data analysis as outlined above, it is then possible to address the three research questions. These are discussed in the following section by revisiting each research question.

3.7.1 Relationship between emotions hope in the future of climate change

For the first research question (RQ1) about the relationship between emotions and hope in the target group, the answer can be based on the five sub-questions (RQ1a to RQ1e), both of which can be readily answered by the above analysis of survey data (Q1 and Q2). For the first sub-question (RQ1a) about self-reported emotions, the frequencies and strength of different

emotions on the emotional profiles (Q1) from the survey present an overview of how the subjects emotionally perceived climate change. For the second sub-question (RQ1b) about the differences in emotions among the target population, the statistical analysis done above revealed presence of any significant differences among different groups in the samples. As mentioned previously, grouping was based on major subjects, year of study and gender. Again, a fourth important comparison was whether the students indicated they had learned about climate change in any course at the undergraduate level.

If there are clear patterns between different subjects, years of study or related learning in courses, it may hint that there are correlations between learning experience and emotions. Estimation of the size of such correlations can give us further hints about the extent of possible influence.

The third sub-question (RQ1c) is answered by our analysis of hope scales. It reveals which type of hope, *constructive hope* or *hope based on denial*, was more common among the samples. The results of this analysis also allowed us to use hope scores as a basis for groupings. These groupings allowed us to answer the next two sub-questions (RQ1d and RQ1e) based on statistical analysis of emotions and perceived communication style of teachers. When these three sub-questions were interpreted together, it became possible to deduce the possible influence of hope about the future of climate change to students' emotions and their perceptions of past learning experience about climate change.

3.7.2 How hope in climate change affect perceptions of future and their past learning experience

For second research question (RQ2) which is addressed by interview data, our analysis of the two sub-questions revealed hints about how hope in climate change affected how students feel about climate change, and also how they perceived their learning experience in the past.

3.7.3 Findings from Lesson observation in Climate change Education

For the third research question (RQ3) about how CCE was being implemented in classroom, the data analysis using the checklist as shown previously in table 3.5 above should provide us with a basis to see how emotional aspects of climate change education were being acknowledged and addressed in exemplar lessons.

By highlighting elements in classroom practices that could potentially affect students emotionally on the issue of climate change, we can determine whether the emotional aspects in climate change education were being addressed properly and proactively by the teachers involved.

Combined together, the first two research questions also inform us in what way emotions and hope in climate change were influenced by previous learning experience. It also reveals how the students perceived climate change education from their perspective. The overall patterns of emotions and hope obtained from the survey inform us about the current status of the students in CCE. We also knew more about the impacts made by the existing curriculum on how students felt about climate change before and after students enter university.

When we combined these observations with the answer to the third question, we also addressed

the important question of whether any influences from school and university curricula were conducive for students to nurture caring and active educators, who should be well prepared to face the reality of climate change of our time. It allowed us to assess whether the existing arrangement of climate change education in the Bachelor of Education curriculum in this university was effective in preparing students for their future role as educators.

Furthermore, these observations also informed suggestions to improve curricular and pedagogical initiatives in climate change education, which are followed up in the discussion section of the current research.

3.8 Summary of this chapter

This chapter presents the research method and instruments used for data collection in the study. As the research questions required a combination of both quantitative and qualitative data, a mixed method research design was adopted.

Despite encountering significant challenges during the data collection process, the current arrangements successfully gathered both quantitative and qualitative data to shed light on how climate change education was perceived emotionally by undergraduate students enrolled in a Bachelor of Education program at a local university. Specific possible sources of threats to the validity of the research process were identified and discussed.

Chapter 4 Data Analysis and Results

4.1 Overview of this chapter

This chapter aims to present the outcomes derived from the data collection process. The discussion will commence with an analysis of the results obtained from the online survey. Subsequently, the findings derived from the writing tasks and interviews will be presented. It will be followed by the results obtained from lesson observations. Each section will also entail a detail analysis, followed by an exploration of the corresponding research questions and sub-questions. The chapter will culminate in a summary of the findings.

4.2 Online survey

As explicated in the prior chapter, the data for the present study was obtained through two distinct phases of online survey administration. The initial round of online survey was carried out between December of 2020 and February of 2021, whereas the second phase was conducted from April to June in 2021. Following the elimination of invalid and duplicated data, a total of 93 valid responses were obtained from the two rounds of survey, with 32 and 61 participants from the first and second phase of data collection, respectively. Instances of invalid data included missing information pertaining to gender, year of study, or area of study, while duplicated entries were identified through the matching of IP addresses recorded by the online survey platform.

4.2.1 Background information of respondents

4.2.1.2 Gender

Among the 93 valid responses, there were 33 male and 60 female respondents. While the

distribution may seem unbalanced, it is however consistent with the overall gender distribution of the undergraduate students in this university.

Table 4.1

Gender Distribution of the Sample

Gender	N	%
Male	33	35.50
Female	60	64.50
Total	93	100

4.2.1.3 Year of study

The survey respondents were found to be fairly evenly distributed across various stages of their academic programs. Specifically, approximately one-third of the participants were enrolled in their first year of undergraduate study (34%), while another one-fourth of the respondents (24%) were in their fourth year of study. Based on these findings, it can be inferred that slightly over half of the respondents originated from the first two years of their academic program, with the remaining half hailing from more advanced stages of study.

Table 4.2

Year Distribution of Survey Respondents

Year	N	%
One	32	34.4%
Two	18	19.4%
Three	11	11.8%
Four	22	23.7%
Five	10	10.8%
Total	93	100%

4.2.1.4 Major subjects of study

The respondents were quite scattered among different major subjects of study in the Bachelor of Education. The first six subjects with more respondents were Science, General Studies, English Language, Mathematics, Physical Education and Geography. The distribution of the respondents among the major areas of study is shown in table 4.3 below.

Table 4.3

Distribution of Major Subjects of Study

Major Subjects of Study	N	%
Chinese Language	7	7.5%
English Language	10	10.8%
Genera Studies	11	11.8%
Mathematics (Primary)	10	10.8%
Physical Education	9	9.7%
Information and Communication Technology	4	4.3%
Mathematics (Secondary)	5	5.4%
Early Childhood Education	6	6.5%
Chinese History	1	1.1%
Geography	9	9.7%
Science	12	12.9%
Liberal Studies	2	2.2%
Visual Arts	7	7.5%
Total	93	100%

It is noticed that some major subjects had very few respondents. For comparisons between major subjects, it is necessary to exclude major subjects with less than 5 respondents as it may be misleading to deduce from such small numbers of respondents. Subjects thus excluded are Chinese History, Information and Communication Technology and Liberal Studies. Otherwise, these cases are still included in other comparisons.

4.2.1.5 University learning in climate change education

Respondents were asked whether they have learnt about climate change in courses in university. In responses, 40 (43%) of them replied they have not. The other 53 (57%) indicated they have learnt about climate change in some university courses. The table 4.4 below shows the distribution of response in different major subject of study.

Table 4.4

Distribution of Students who Have Learnt about Climate Change at University Level

Major Subjects of Study	I **have not learnt** about climate change in any course at university level.	I **have learnt** about climate change mostly from the courses in this university.	Total
Chinese Language	4	3	7
English Language	4	6	10
Genera Studies	4	7	11
Mathematics (Primary)	6	4	10
Physical Education	7	2	9
Information and Communication Technology	2	2	4
Mathematics (Secondary)	3	2	5
Early Childhood Education	0	6	6
Chinese History	0	1	1
Geography	0	9	9
Science	6	6	12
Liberal Studies	0	2	2
Visual Arts	4	3	7
Total	40	53	93

As we proceed with the analysis of survey result, we will also address the first Research Questions RQ1, which is shown as following.

Research question 1 (RQ1): What is the relationship between hope and emotions to climate change among students of Bachelor of Education programme?

RQ1a: What are the most common self-reported emotions of students of Bachelor of Education programme to climate change?

RQ1b: What are the differences, if any, in self-reported emotions among students of Bachelor of Education programme?

RQ1c: Which type of hope is more commonly possessed by students of Bachelor of Education programme to climate change?

RQ1d: In what ways do students' hope in climate change affect their emotions to climate change?

RQ1e: In what ways do students' hope in climate change affect how students perceived communication style of teachers in the past?

We start our analysis to address the first two sub-questions RQ1a and RQ1b. It is done in the following section 4.2.2.

4.2.2 Emotions about climate change

To address the sub-questions related to RQ1a, we analyzed the distribution of emotions reported in the online survey. Specifically, participants were asked to indicate the various emotions they experienced when you think about climate change, and the intensity of each emotion was assessed using a five-point rating scale ranging from "1=not at all" to "5=strongly". The results revealed substantial variability in the overall intensity of the 21 different emotions reported by the respondents. The results are shown in table 4.5 below.

Table 4.5

Emotions about Climate Change in the Sample on 5-point Scale

Emotions	Mean	N	Std. Deviation
Determined	3.32	93	0.97
Fascinated	2.65	93	1.09
Hopeful	2.37	93	0.95
Apathy	2.09	92	0.93
Powerless	3.46	93	1.20
Overwhelmed	2.91	93	1.10
Pessimistic	3.16	93	1.08
Discouraged	2.92	93	1.10
Upset	2.90	93	1.16
Confused	2.52	93	1.03
Sad	2.96	93	1.15
Concerned	3.78	92	0.98
Worried	3.86	93	1.03
Disgusted	1.82	93	0.92
Ashamed	2.45	93	1.16
Fearful	3.06	93	1.17
Angry	2.59	93	1.12
Frustrated	2.74	92	1.13
Surprised	2.14	93	1.02
Joyful	1.60	93	0.92
Bored	1.68	93	0.84

In light of the relatively modest sample size, the standard deviations of the survey responses were found to be quite large. As such, it is crucial to approach the interpretation of the emotion scores with caution, given the potential for increased variability and decreased precision associated with smaller sample sizes.

We are now prepared to address sub-question RQ1a, which is presented below.

Sub-questions 1a (RQ1a):

What are the most common self-reported emotions of students of Bachelor of Education programme to climate change?

There were only six emotions found to have mean scores exceeding 3.0 on the 5-point scale. These emotions were *determined* (3.32), *powerless* (3.46), *pessimistic* (3.16), *concerned* (3.78), *worried* (3.86), and *fearful* (3.06), suggesting that they were more commonly experienced by the participants.

Conversely, three emotions were found to have the lowest mean scores, falling below 2.0 on a scale of 1 to 5. These emotions were *disgusted* (1.82), *joyful* (1.60), *and bored* (1.68), indicating that they were among the least frequently experienced emotions reported by the respondents.

In addition to analyzing mean scores, the distribution of responses was also examined, as presented in Table 4.5a below.

Table 4.5a

Emotions with the highest mean scores

	Determined		Powerless		Pessimistic		Concerned		Worried		Fearful	
Response	N	%	N	%	N	%	N	%	N	%	N	%
1=Not at all	6	6.1%	7	7.1%	7	7.1%	4	4.0%	5	5.1%	14	14.1%
2	6	6.1%	15	15.2%	18	18.2%	3	3.0%	3	3.0%	15	15.2%
3	46	46.5%	23	23.2%	32	32.3%	25	25.3%	19	19.2%	32	32.3%
4	30	30.3%	32	32.3%	33	33.3%	43	43.4%	45	45.5%	29	29.3%
5=Strongly	10	10.1%	21	21.2%	8	8.1%	22	22.2%	26	26.3%	8	8.1%
Missing	1	1.0%	1	1.0%	1	1.0%	2	2.0%	1	1.0%	1	1.0%

Using a 5-point Likert scale, a rating of either 4 or 5 may be considered to clearly represent the presence of a given emotion, while a rating of 3 may be interpreted as somewhat ambiguous. Applying these criteria, the percentage of respondents exhibiting the six most frequently reported emotions ranged from a low of 39.8% for fear to a high of 73.1% for worry. The remaining four emotions, namely, determined, powerless, pessimistic, and concerned, were reported by 42.0%, 54.8%, 41.9%, and 67.4% of the participants, respectively. Notably, more

than half of the surveyed students reported experiencing the emotions of powerlessness, concern, and worry.

The mean scores for the remaining twelve emotions ranged from 2.0 to 3.0, indicating that these emotions were present among the respondents but not particularly strong. These emotions included fascinated (2.65), hopeful (2.37), apathy (2.09), overwhelmed (2.91), discouraged (2.92), upset (2.90), confused (2.52), sad (2.96), ashamed (2.45), angry (2.59), frustrated (2.74), and surprised (2.14).

Taken together, the findings suggest that the target population of university students studying Bachelor of Education, as a whole, experienced mild levels of concern and worry regarding climate change. However, they also reported experiencing conflicting emotions of powerlessness and determination, while fear about the climate change situation was also prominent but not the strongest emotion reported. The implications of these results are discussed further in the following chapter.

4.2.2.1 Most common emotions among students

In summary, the analysis conducted in response to sub-question RQ1a revealed that the most frequently self-reported emotions regarding climate change were worry (71.8%), concern (65.6%), and powerlessness (53.5%). More than half of the respondents reported experiencing these three emotions. Conversely, emotions such as pessimism (41.4%), determination (40.4%), and fear (37.4%) were less commonly reported by the participants.

4.2.2.2 Comparison of emotions between different groups

After we have studied the overall distribution of emotions, we proceed with the next sub-question RQ1b.

Sub-question RQ1b:

What are the differences, if any, in self-reported emotions among students of Bachelor of Education programme?

To address this sub-question, analyses were conducted to determine if there were any significant differences between various subgroups of the sample population. The grouping criteria consisted of four factors: gender, year of study, major area of study, and prior exposure to climate change education through university-level courses. The statistical tests utilized to examine these factors were presented in the following four paragraphs. It is noted that the present data about emotions and hope measured in Likert-scales are ordinal in nature and therefore warrant non-parametric statistical tests. However, there has been continuous debate in recent decades on whether parametric methods or non-parametric methods are considered acceptable in analyzing Likert-scale data (Chen & Liu, 2020; Murray, 2013). In following analyses, parametric statistical tests were applied in analyzing such data as they were considered reasonably close approximation.

4.2.2.3 Comparison of emotions by gender

The participants were grouped based on their gender, and subsequent calculations were performed to determine the mean scores for each of the 21 emotions related to climate change. These results were presented in Table 4.6 and Figure 1.

Table 4.6

Comparison of Emotions by Gender

Emotions	Gender	N	Mean	Std. Deviation	Std. Error Mean
Determined	Male	33	3.27	1.13	0.20
	Female	60	3.35	0.88	0.11
Fascinated	Male	33	2.76	1.15	0.20
	Female	60	2.58	1.06	0.14
Hopeful	Male	33	2.55	1.00	0.18
	Female	60	2.27	0.92	0.12
Apathy	Male	32	2.19	0.97	0.17
	Female	60	2.03	0.92	0.12
Powerless	Male	33	3.24	1.35	0.23
	Female	60	3.58	1.11	0.14
Overwhelmed	Male	33	2.91	1.04	0.18
	Female	60	2.92	1.14	0.15
Pessimistic	Male	33	2.97	1.16	0.20
	Female	60	3.27	1.02	0.13
Discouraged	Male	33	2.79	1.08	0.19
	Female	60	3.00	1.11	0.14
Upset**	Male	33	2.48	1.06	0.19
	Female	60	3.13	1.16	0.15
Confused	Male	33	2.48	0.97	0.17
	Female	60	2.53	1.07	0.14
Sad*	Male	33	2.64	1.08	0.19
	Female	60	3.13	1.16	0.15
Concerned	Male	32	3.69	0.97	0.17
	Female	60	3.83	0.99	0.13
Worried	Male	33	3.64	1.17	0.20
	Female	60	3.98	0.93	0.12
Disgusted*	Male	33	2.09	1.04	0.18
	Female	60	1.67	0.82	0.11
Ashamed	Male	33	2.33	0.99	0.17
	Female	60	2.52	1.24	0.16
Fearful	Male	33	2.85	1.18	0.21
	Female	60	3.18	1.16	0.15
Angry	Male	33	2.52	0.97	0.17
	Female	60	2.63	1.19	0.15
Frustrated	Male	33	2.45	1.03	0.18
	Female	59	2.90	1.16	0.15
Surprised	Male	33	2.33	1.05	0.18
	Female	60	2.03	0.99	0.13
Joyful**	Male	33	2.03	1.08	0.19
	Female	60	1.37	0.74	0.10
Bored	Male	33	1.82	0.85	0.15
	Female	60	1.60	0.83	0.11

Note: * p <0.05   ** p<0.01

Figure 3

Comparison of Emotions by Gender
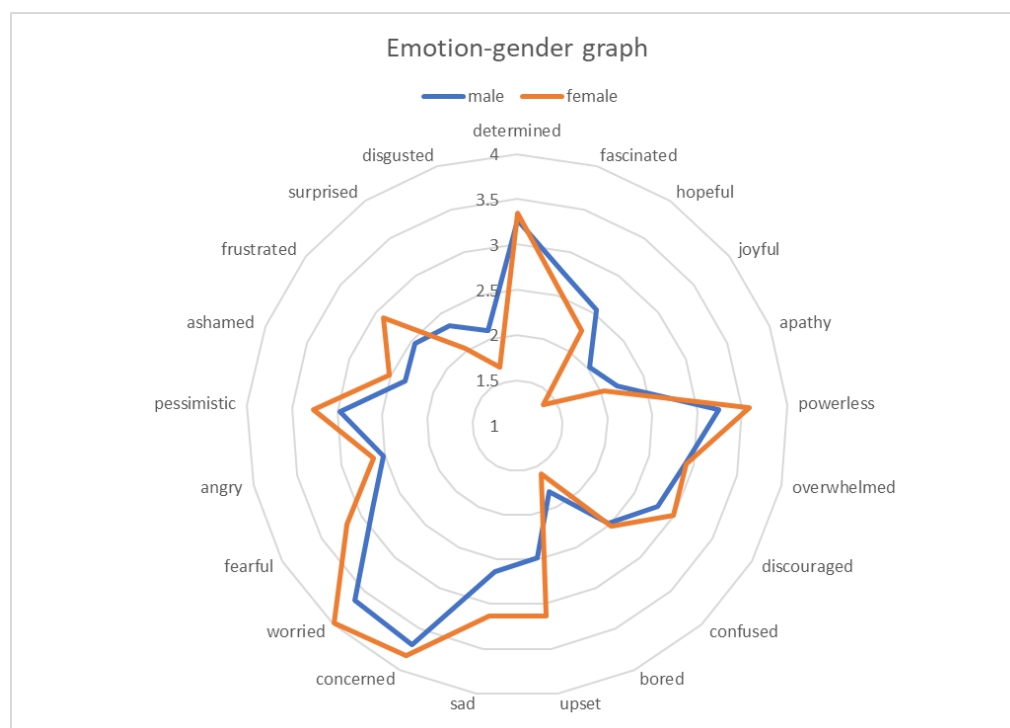
To assess whether the differences among male and female students regarding their emotions are significant, independent sample t-tests were conducted for all 21 emotions. The results indicated that gender differences were only statistically significant for four emotions: upset ($t=-2.660$, $df=91$, $p<0.01$), sad ($t=-2.026$, $df=91$, $p<0.05$), disgusted ($t=2.170$, $df=91$, $p<0.05$), and joyful ($t=3.163$, $df=91$, $p<0.01$). Other than these emotions, there were no significant differences between male and female students in their emotions to climate change at a 95% confidence level.

As a group, female students reported feeling more *upset* about climate change than male students. Female students also felt more *sadness*. The differences in the emotions of disgust and joy were also significant. However, the mean scores for these latter two emotions were quite low, falling within the range of 1.0 to 2.1 on a 5-point Likert scale. As "1" on the Likert

scale represented "not at all", mean scores within this range indicated that the related emotions were quite weak. Therefore, the observed gender differences in these two weak emotions of *disgust* and *joy* should be interpreted with caution.

4.2.2.4 Comparison of emotions by year of study

Comparing the emotions reported across different years of study revealed some notable observations. The variations of all emotions across different years of study were presented in Table 4.7 and Figure 4.

Table 4.7

Variation of Emotions among Different Years of Study

Emotions	Year One			Year Two			Year Three			Year Four			Year Five			Total		
	Mean	N	Std. Error of Mean	Mean	N	Std. Error of Mean	Mean	N	Std. Error of Mean	Mean	N	Std. Error of Mean	Mean	N	Std. Error of Mean	Mean	N	Std. Error of Mean
Determined	3.13	32	0.15	3.44	18	0.18	3.45	11	0.37	3.36	22	0.26	3.50	10	0.27	3.32	93	0.10
Fascinated	2.66	32	0.17	2.67	18	0.27	2.64	11	0.34	2.55	22	0.28	2.80	10	0.36	2.65	93	0.11
Hopeful	2.38	32	0.18	2.33	18	0.23	2.18	11	0.18	2.41	22	0.23	2.50	10	0.27	2.37	93	0.10
Apathy	1.87	31	0.14	2.17	18	0.22	2.27	11	0.24	2.23	22	0.25	2.10	10	0.28	2.09	92	0.10
Powerless*	3.13	32	0.21	3.11	18	0.27	3.73	11	0.33	3.77	22	0.27	4.20	10	0.25	3.46	93	0.12
Overwhelmed	2.63	32	0.18	2.83	18	0.20	3.09	11	0.25	3.23	22	0.28	3.10	10	0.43	2.91	93	0.11
Pessimistic	2.97	32	0.17	3.28	18	0.28	3.00	11	0.27	3.32	22	0.27	3.40	10	0.31	3.16	93	0.11
Discouraged	2.66	32	0.19	2.94	18	0.26	3.00	11	0.23	3.18	22	0.27	3.10	10	0.31	2.92	93	0.11
Upset	2.63	32	0.21	2.89	18	0.25	3.09	11	0.25	3.36	22	0.26	2.60	10	0.40	2.90	93	0.12
Confused	2.31	32	0.16	2.56	18	0.20	2.45	11	0.31	2.86	22	0.27	2.40	10	0.34	2.52	93	0.11
Sad	2.81	32	0.20	2.89	18	0.27	3.27	11	0.36	3.00	22	0.27	3.10	10	0.35	2.96	93	0.12
Concerned	3.63	32	0.19	3.65	17	0.17	4.09	11	0.25	3.95	22	0.25	3.80	10	0.20	3.78	92	0.10
Worried	3.53	32	0.20	4.17	18	0.17	4.27	11	0.24	3.82	22	0.24	4.00	10	0.30	3.86	93	0.11
Disgusted	1.78	32	0.14	2.28	18	0.25	1.64	11	0.28	1.64	22	0.20	1.70	10	0.26	1.82	93	0.10
Ashamed	2.41	32	0.18	2.83	18	0.29	2.64	11	0.39	2.18	22	0.27	2.30	10	0.33	2.45	93	0.12
Fearful	2.97	32	0.21	3.06	18	0.27	3.27	11	0.30	3.14	22	0.26	3.00	10	0.45	3.06	93	0.12
Angry	2.50	32	0.19	2.39	18	0.27	2.82	11	0.26	2.82	22	0.25	2.50	10	0.43	2.59	93	0.12
Frustrated	2.68	31	0.20	2.61	18	0.28	2.73	11	0.24	2.86	22	0.28	2.90	10	0.31	2.74	92	0.12
Surprised	2.13	32	0.17	2.33	18	0.26	2.18	11	0.26	2.09	22	0.25	1.90	10	0.31	2.14	93	0.11
Joyful	1.69	32	0.18	1.78	18	0.26	1.73	11	0.30	1.36	22	0.14	1.40	10	0.22	1.60	93	0.10
Bored	1.66	32	0.17	1.94	18	0.17	1.45	11	0.21	1.64	22	0.17	1.60	10	0.27	1.68	93	0.09

Note: * Significant difference at 95% confident level (p<0.05)

Figure 4

Variation of Emotions across Years of Study
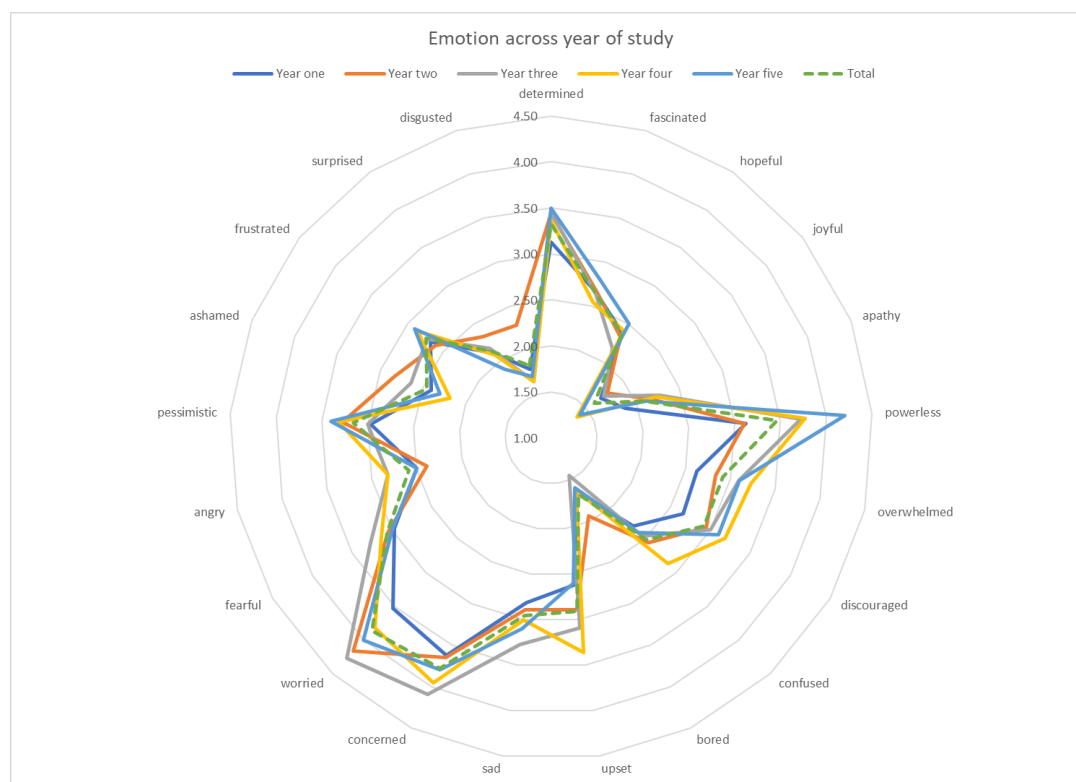
To examine whether the variations of different emotions among different years of study were statistically significant, one-way ANOVA tests were conducted on the 21 emotion scores using year of study as a single factor. The results indicated that only one emotion, *powerlessness*, shows statistically significant difference (F=2.626, df=4, p<0.05) among the different years of study. The score for the *powerlessness* emotion was observed to increase consistently with each year of study, rising from just above 3 for the first two years of study to over 4.2 for the final and fifth year of study. However, post hoc analysis with Turkey's honest significant difference test indicated that none of the pairwise year-by-year comparisons were significant at 95% confidence interval. These results were presented in Table 4.7a.

Table 4.7a

Variation of Mean of Emotion Powerless across Years of Study

Year	Mean	N	Std. Error of Mean
One	3.13	32	0.21
Two	3.11	18	0.27
Three	3.73	11	0.33
Four	3.77	22	0.27
Five	4.20	10	0.25
Total	3.46	93	0.12

The analysis indicated that students in more advanced years of their studies felt more powerless about climate change than those in earlier years. This trend had significant implications, which are discussed in the following chapter.

4.2.2.5 Comparisons of emotions by major subjects of study

The emotions scores were compared across different major subjects of study using one-way ANOVA tests, with major subjects of study serving as the factor. To ensure that sound conclusions were drawn, only the ten major subjects with at least five responses were included in the analysis. Each of the 21 emotions was tested against the null hypothesis that the mean of the emotion remained the same across the different major subjects. The results of the analysis were presented in Table 4.8.

Table 4.8a

Variations of Emotions among Major Subjects of Study

Major Subject of Study		Determined	Fascinated	Hopeful	Apathy	Powerless	Overwhelmed	Pessimistic	Discouraged	Upset	Confused	Sad
Chinese Language (N=7)	Mean	2.57	2.14	1.86	1.71	3.29	2.71	2.86	2.57	3.00	2.57	2.86
	Std. Error of Mean	0.37	0.34	0.26	0.29	0.42	0.42	0.40	0.37	0.53	0.37	0.46
English Language (N=10)	Mean	3.30	3.10	2.60	2.30	3.80	3.00	3.50	3.20	2.90	2.30	3.20
	Std. Error of Mean	0.37	0.43	0.40	0.21	0.33	0.42	0.34	0.42	0.46	0.37	0.36
Genera Studies (N=11)	Mean	3.36	2.45	2.27	1.91	3.36	2.82	3.45	2.91	2.82	2.45	3.27
	Std. Error of Mean	0.28	0.25	0.19	0.25	0.34	0.33	0.39	0.39	0.35	0.28	0.27
Mathematics (Primary) (N=10)	Mean	3.40	2.90	2.50	2.10	3.10	2.50	3.00	2.90	2.90	2.40	2.90
	Std. Error of Mean	0.22	0.38	0.27	0.18	0.43	0.31	0.30	0.31	0.35	0.34	0.38
Physical Education (N=9)	Mean	3.22	2.78	2.33	1.89	3.89	3.44	3.44	3.22	3.11	2.78	3.33
	Std. Error of Mean	0.15	0.28	0.29	0.31	0.26	0.29	0.29	0.28	0.26	0.28	0.29
Mathematics (Secondary) (N=5)	Mean	3.60	3.20	2.40	2.20	3.60	2.80	3.20	3.00	3.20	2.60	3.20
	Std. Error of Mean	0.24	0.20	0.51	0.58	0.87	0.49	0.58	0.71	0.73	0.40	0.80
Early Childhood Education	Mean	3.17	2.33	2.33	2.33	2.50	2.50	2.50	2.00	2.67	2.17	2.50
	Std. Error of Mean	0.17	0.21	0.49	0.49	0.43	0.43	0.43	0.37	0.42	0.48	0.43
Geography (N=9)	Mean	3.89	3.22	2.67	2.22	3.00	2.22	2.78	2.89	2.78	1.78	2.11
	Std. Error of Mean	0.42	0.52	0.37	0.22	0.41	0.28	0.32	0.31	0.32	0.28	0.31
Science (N=12)	Mean	3.00	2.50	2.17	1.91	3.83	3.50	3.17	3.08	2.92	2.83	3.08
	Std. Error of Mean	0.30	0.29	0.24	0.28	0.30	0.29	0.21	0.23	0.36	0.32	0.36
Visual Arts (N=7)	Mean	3.43	1.86	2.00	2.00	3.86	3.29	3.86	3.29	3.29	3.29	3.14
	Std. Error of Mean	0.53	0.34	0.22	0.49	0.40	0.52	0.51	0.52	0.52	0.42	0.46
Total (N=86)	Mean	3.29	2.66	2.33	2.05	3.45	2.91	3.20	2.94	2.94	2.51	2.98
	Std. Error of Mean	0.10	0.12	0.10	0.09	0.13	0.12	0.11	0.12	0.13	0.11	0.12

Table 4.8b

Variations of Emotions among Major Subjects of Study (Cont.)

Major Subject of Study		Concerned	Worried	Disgusted	Ashamed	Fearful	Angry	Frustrated	Surprised	Joyful	Bored
Chinese Language (N=7)	Mean	3.57	3.57	1.57	2.71	2.86	2.57	2.86	2.00	1.29	1.43
	Std. Error of Mean	0.53	0.48	0.20	0.47	0.46	0.43	0.40	0.31	0.18	0.20
English Language (N=10)	Mean	3.70	3.70	1.80	2.40	3.10	2.50	2.90	2.50	1.90	2.00
	Std. Error of Mean	0.37	0.47	0.25	0.45	0.41	0.43	0.38	0.45	0.41	0.42
Genera Studies (N=11)	Mean	3.91	4.36	1.73	2.82	3.09	2.36	2.40	1.64	1.45	1.18
	Std. Error of Mean	0.16	0.15	0.24	0.30	0.31	0.24	0.34	0.20	0.25	0.12
Mathematics (Primary) (N=10)	Mean	3.70	4.00	2.30	2.30	2.90	2.90	2.70	2.10	1.70	2.40
	Std. Error of Mean	0.21	0.26	0.33	0.37	0.38	0.38	0.33	0.35	0.30	0.27
Physical Education (N=9)	Mean	3.88	3.78	2.22	2.89	3.00	2.78	3.00	2.56	1.89	1.78
	Std. Error of Mean	0.30	0.32	0.43	0.35	0.37	0.28	0.29	0.29	0.26	0.28
Mathematics (Secondary) (N=5)	Mean	3.80	3.80	1.80	3.20	4.00	3.20	3.20	2.20	1.40	1.40
	Std. Error of Mean	0.37	0.58	0.37	0.58	0.45	0.58	0.58	0.37	0.40	0.24
Early Childhood Education	Mean	3.50	3.67	1.83	2.33	2.67	1.83	2.50	1.83	1.50	1.67
	Std. Error of Mean	0.43	0.33	0.40	0.42	0.61	0.31	0.43	0.31	0.34	0.42
Geography (N=9)	Mean	3.78	3.44	1.44	2.33	2.89	2.22	2.56	2.00	1.33	1.44
	Std. Error of Mean	0.43	0.41	0.29	0.44	0.31	0.40	0.38	0.44	0.24	0.24
Science (N=12)	Mean	4.08	3.92	2.00	2.08	3.00	3.08	2.83	2.58	1.67	1.83
	Std. Error of Mean	0.19	0.26	0.28	0.29	0.37	0.36	0.41	0.29	0.22	0.21
Visual Arts (N=7)	Mean	4.14	4.29	1.29	2.14	3.57	3.14	3.43	1.71	1.00	1.43
	Std. Error of Mean	0.46	0.18	0.29	0.46	0.37	0.26	0.37	0.29	0.00	0.20
Total (N=86)	Mean	3.82	3.87	1.83	2.49	3.07	2.66	2.81	2.14	1.55	1.69
	Std. Error of Mean	0.10	0.11	0.10	0.12	0.12	0.12	0.12	0.11	0.09	0.09

Based on the results of the aforementioned one-way ANOVA tests, none of the 21 listed emotions exhibited significant differences across the various major subjects of study at 95% confidence level. Therefore, the null hypothesis could not be rejected. These findings suggest that the emotions of the students were not substantially different across different major subjects of study.

4.2.2.6 Comparison of emotions by university level course in climate change

Finally, a comparison was made between students who reported having learned about climate change in university-level courses and those who had not. To achieve this, independent sample t-tests were conducted on each of the 21 emotions between the two groups of students, with

the null hypothesis for each emotion being no differences in emotion scores between the two groups.

The results of these tests were presented in Table 4.9, and Figure 5 provided a graphical representation of the same data.

Figure 5

Comparison of Emotions between Those Learnt about Climate Change in University Courses and Those who Have Not
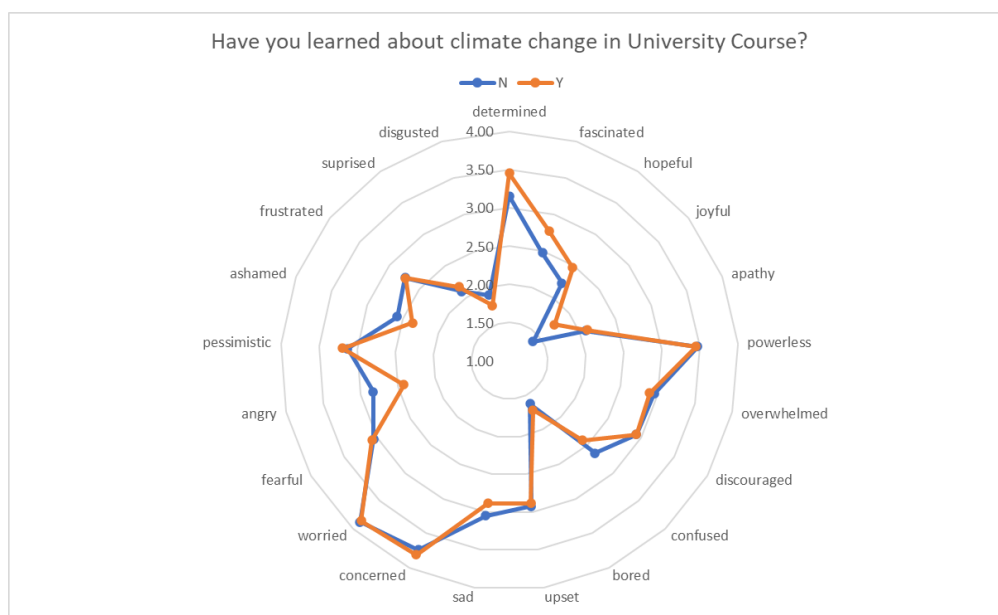
Table 4.9

Comparison of Emotions between Those Learnt about Climate Change in University Courses

and Those who Have Not

	Learnt about climate change in university course?	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	Significant?
Determined	n	40	3.15	1.05	0.17	-1.50	91	0.14	N
	y	53	3.45	0.89	0.12				
Fascinated	n	40	2.48	1.04	0.16	-1.31	91	0.19	N
	y	53	2.77	1.12	0.15				
Hopeful	n	40	2.23	0.83	0.13	-1.24	91	0.22	N
	y	53	2.47	1.03	0.14				
Apathy	n	40	2.08	1.05	0.17	-0.11	90	0.91	N
	y	52	2.10	0.85	0.12				
Powerless	n	40	3.48	1.20	0.19	0.09	91	0.93	N
	y	53	3.45	1.22	0.17				
Overwhelmed	n	40	2.95	1.15	0.18	0.27	91	0.79	N
	y	53	2.89	1.07	0.15				
Pessimistic	n	40	3.13	1.09	0.17	-0.28	91	0.78	N
	y	53	3.19	1.08	0.15				
Discouraged	n	40	2.93	1.14	0.18	0.00	91	1.00	N
	y	53	2.92	1.07	0.15				
Upset	n	40	2.93	1.14	0.18	0.16	91	0.88	N
	y	53	2.89	1.19	0.16				
Confused	n	40	2.65	1.00	0.16	1.09	91	0.28	N
	y	53	2.42	1.05	0.14				
Sad	n	40	3.05	1.11	0.18	0.68	91	0.50	N
	y	53	2.89	1.19	0.16				
Concerned	n	39	3.74	1.04	0.17	-0.33	90	0.75	N
	y	53	3.81	0.94	0.13				
Worried	n	40	3.88	1.11	0.18	0.12	91	0.90	N
	y	53	3.85	0.97	0.13				
Disgusted	n	40	1.90	0.96	0.15	0.75	91	0.45	N
	y	53	1.75	0.90	0.12				
Ashamed	n	40	2.58	1.22	0.19	0.89	91	0.37	N
	y	53	2.36	1.11	0.15				
Fearful	n	40	3.05	1.24	0.20	-0.10	91	0.92	N
	y	53	3.08	1.12	0.15				
Angry	n	40	2.83	1.15	0.18	1.77	91	0.08	N
	y	53	2.42	1.06	0.15				
Frustrated	n	39	2.74	1.12	0.18	0.03	90	0.97	N
	y	53	2.74	1.15	0.16				
Surprised	n	40	2.10	0.90	0.14	-0.33	91	0.75	N
	y	53	2.17	1.10	0.15				
Joyful	n	40	1.40	0.63	0.10	-1.99	86	0.05	Y
	y	53	1.75	1.07	0.15				
Bored	n	40	1.63	0.70	0.11	-0.52	91	0.60	N
	y	53	1.72	0.93	0.13				

Surprisingly, the results of the aforementioned t-tests indicated that there were no observable differences in emotions between students who had studied climate change at the university level and those who had not. Nearly all t-tests revealed that differences in emotions between the two groups of students were not statistically significant at a 95% confidence interval. The only exception was the emotion of joy, with t=-1.992 and p=0.0495, which approached the threshold of p<0.05 and was considered marginally significant at a 95% confidence interval. However, the mean scores for joy of both groups were below 2.0 on the Likert scale. As 1.0 represented "not at all" on the Likert scale, it suggested that this emotion was quite weak among the participants.

4.2.2.7 Comparisons based on emotions sub-groups

As previously noted in Chapter 3, the list of emotions can be categorized into four subgroups, as demonstrated in Table 2. The mean scores of the emotions in these four subgroups had been assigned the designations E1 to E4, as shown in the following.

Positive emotions (E1): Determined, fascinated, hopeful, joyful

Negative emotions with possible implications of inaction (E2): apathy, powerless, overwhelmed, discouraged, confused, bored

Negative emotions with possible implications on action (E3): upset, sad, concerned, worried, fearful, angry

Negative emotions with no clear implications on action (E4): pessimistic, ashamed, frustrated, surprised, disgusted

The next analysis was conducted to examine whether students who had studied climate change in university courses had different emotional reactions to climate change than those who had

not. To achieve this, we compared the means of the four emotion subgroups (E1 to E4) between the two groups using independent sample t-tests, with participation in university course in climate change as the factor.

The results of this analysis, as presented in Table 4.9a, revealed that there were small but significant differences between the two groups in the positive emotions subgroup (E1) at a 95% confidence level (t=-2.018, df=91, p=0.046<0.05). However, there were no significant differences observed for the other three subgroups, E2, E3, and E4.

Table 4.9a

Comparison of Score in Subgroups of Emotions, with Learnt about Climate Change in University Course as the factor

	Learnt about climate change in university course?	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
E1	n	40	2.31	0.65	0.10	-2.02	91	0.05
	y	53	2.61	0.75	0.10			
E2	n	40	2.62	0.72	0.11	0.29	90	0.77
	y	52	2.57	0.68	0.09			
E3	n	39	3.24	0.90	0.14	0.48	90	0.64
	y	53	3.15	0.81	0.11			
E4	n	39	2.50	0.80	0.13	0.36	90	0.72
	y	53	2.44	0.71	0.10			

The results of the analysis indicated that, among the surveyed students, those who had learned about climate change in university courses reported slightly more positive emotions. Specifically, for those who had studied climate change in university courses, the mean score for E1 was 2.61, which was significantly higher than the mean of 2.31 for those who had not undergone such learning experiences. However, as the mean scores for both groups were less than the median (3.0), it can be concluded that these emotions were still relatively weak.

To summarize the comparisons between different groups above and answering sub-question 1a, there were a few notable differences in emotions toward the future of climate change which can be further explored. Current analysis suggested that students in more advanced years of their studies tend to feel more powerless about climate change than those in earlier years. However, there were no significant differences observed in reported emotions among students in different years or major subjects of study. When male and female students were compared, it was found that female students felt more upset and sadder about climate change than male students.

Regarding the comparison between students who had studied climate change in university courses and those who had not, the analysis revealed no significant differences in the reported emotions, except for the emotion of joy, which was slightly higher among students who had studied climate change in university courses. However, it is important to note that even among those who had studied climate change, the emotions remained relatively weak.

Finally, when the positive and negative emotions were examined, it was found that positive emotions were slightly more common among students who had studied climate change in university courses. Nevertheless, these emotions were still relatively weak.

4.2.3 Hope

The subsequent segment of the analysis focused on the constructs of hope, which was addressed by the sub-question RQ1c. The analysis aims to identify the most common types of hope among the surveyed students.

As expounded in the preceding chapter, the items on the hope scale ranged from 0 to 6. The

means of the items on the hope scale were presented in the subsequent table. Four of the items (Hb, Hd, Hh, Hl) corresponded to the *hope based on denial of climate change* scale, while the other eight items (Ha, Hc, He, Hf, Hg, Hi, Hj, Hk) corresponded to the *constructive hope* scale. The means of the items in these two groups were indicated as *hope_positive* and *hope_denial* in Table 4.10a and Table 4.10b.

Table 4.10a

Constructive Hope Scale with a scale of 0-6

	Mean	N	Std. Deviation	Std. Error of Mean
Ha. Because I believe that research and technical solutions will contribute to the improvement of the climate change problem.	3.60	93	1.38	0.14
Hc. Because we as individuals can change our behavior, together we can influence climate change in a positive direction.	3.86	93	1.61	0.17
He. Because the awareness about this problem has increased considerably during recent years.	3.89	93	1.31	0.14
Hf. Because politicians in more and more countries take climate change seriously.	3.33	93	1.48	0.15
Hg. Because ultimately we will be forced to take climate problems seriously and to take our responsibility.	3.76	93	1.54	0.16
Hi. Because as long as there are people who are active in environmental organizations there is a possibility that the climate issue will be solved.	2.87	93	1.49	0.15
Hj. Because I know that there are a number of things that I myself can do to contribute to the improvement of the climate change problem.	3.62	93	1.37	0.14
Hk. Because I try to focus on positive news about climate change in the media.	2.48	93	1.49	0.15
hope_positive	3.43	93	1.08	0.11

Table 4.10b

Hope Scale Based on Denial with a scale of 0-6

	Mean	N	Std. Deviation	Std. Error of Mean
Hb. Because I do not think that climate change is as big of a problem as certain researchers claim.	1.67	93	1.81	0.19
Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.	2.33	93	1.95	0.20
Hh. Because I doubt that there is any change in the climate.	1.89	93	1.70	0.18
Hl. Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change.	1.41	93	1.71	0.18
hope_denial	1.83	93	1.44	0.15

Overall, the mean scores of all items corresponding to *constructive hope* were found to be much higher than those of *hope based on denial of climate change*. This suggested that, as a whole, the surveyed students possessed stronger *constructive hope* than *hope based on denial of climate change*. In essence, the students surveyed had a stronger belief that climate change can be resolved, rather than a belief denying the existence of climate change.

A more in-depth examination was conducted by analyzing the individual items on the hope scale. The mean scores of the items on the sub-scale of *constructive hope* ranged from 2.48 to 3.89. The highest mean score (3.89) corresponded to the item "because the awareness about this problem has increased considerably during recent years." The lowest mean score (2.48) corresponded to the item Hk, "because I try to focus on positive news about climate change in the media." The next lowest mean score (2.87) corresponds to the item Hi, "because as long as there are people who are active in environmental organizations there is a possibility that the climate issue will be solved." Both Hi and Hk had a mean score lower than 3.0, which was the median of the scale of 0 to 6, indicating that these two items were relatively weaker sources of

constructive hope.

The means of the four items on the sub-scale of *hope based on denial* of climate change ranged from 1.41 to 2.33. The lowest mean score (1.41) belonged to the item "because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change." The highest mean score (2.33) belonged to the item "Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create." This was also the only item in this sub-scale that had a mean score higher than 2.0, indicating that more respondents agreed with this statement. This finding is quite alarming and worrisome.

Since only limited information was obtained from the mean scores of the items, a more detailed analysis of the distributions was necessary. The frequency distributions of the four items in the *hope based on denial* of climate change sub-scale were presented in Table 4.10c. On the scale of 0 to 6, a score of 4 or above indicated that the respondents agreed with the item. The data indicate that a significant proportion of the respondents agreed with the four ideas on denial of climate change (Hb, Hd, Hh, Hl). The percentages of respondents agreeing to the items Hb, Hd, Hh, and Hl were approximately 17%, 35%, 21%, and 18%, respectively. Perhaps the most concerning finding was related to item Hd, where over one-third of the surveyed students agreed with it, indicating that they believed climate change is natural and doubt that it is caused by human activities. This is a particularly alarming observation from the perspective of climate change education, which is explored further in the following.

Table 4.10c

Frequency Distribution of items of Hope Based on Denial of Climate Change

Hb. Because I do not think that climate change is as big of a problem as certain researchers claim.

	Frequency	Percent	Valid Percent	Cumulative Percent
0=Not at all	34	36.6	36.6	36.6
1	19	20.4	20.4	57.0
2	15	16.1	16.1	73.1
3	9	9.7	9.7	82.8
4	5	5.4	5.4	88.2
5	7	7.5	7.5	95.7
6=Very well	4	4.3	4.3	100.0
Total	93	100.0	100.0	

Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.

	Frequency	Percent	Valid Percent	Cumulative Percent
0=Not at all	24	25.8	25.8	25.8
1	15	16.1	16.1	41.9
2	13	14.0	14.0	55.9
3	8	8.6	8.6	64.5
4	17	18.3	18.3	82.8
5	12	12.9	12.9	95.7
6=Very well	4	4.3	4.3	100.0
Total	93	100.0	100.0	

Hh. Because I doubt that there is any change in the climate.

	Frequency	Percent	Valid Percent	Cumulative Percent
0=Not at all	30	32.3	32.3	32.3
1	15	16.1	16.1	48.4
2	9	9.7	9.7	58.1
3	19	20.4	20.4	78.5
4	15	16.1	16.1	94.6
5	4	4.3	4.3	98.9
6=Very well	1	1.1	1.1	100.0
Total	93	100.0	100.0	

HI. Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change.

	Frequency	Percent	Valid Percent	Cumulative Percent
0=Not at all	45	48.4	48.4	48.4
1	12	12.9	12.9	61.3
2	12	12.9	12.9	74.2
3	7	7.5	7.5	81.7
4	13	14.0	14.0	95.7
5	2	2.2	2.2	97.8
6=Very well	2	2.2	2.2	100.0
Total	93	100.0	100.0	

In response to sub-question RQ1c about the two types of hope, it can be inferred that the surveyed students had a greater tendency to possess *constructive hope* in the future of climate change rather than *hope based on denial* of climate change. Nevertheless, the result also indicates that significant proportions of the surveyed students harbored *hope based on denial* of climate change. In particular, the concerning finding is that over one-third of the surveyed students held the misconception that climate change is natural and doubt that it is caused by human activities.

4.2.3.1 Comparison of hope between different groups

The available data also enabled us to explore whether these two types of hope have significantly different distributions within different groupings. These were explored in the following paragraphs.

4.2.3.2 Hope-major subjects of study

To investigate whether there existed any variations in respondents' hope scores based on their educational backgrounds, one-way ANOVA tests were conducted on the hope scores, with major subjects of study serving as the independent variable. Only subjects that garnered more

than five responses were analyzed. The null hypotheses posited that the mean scores of hope were uniform across different subjects.

Both sub-scales, namely *constructive hope* (*hope_positive*) and *hope based on denial* (*hope_denial*), were evaluated. For the sub-scale of *constructive hope*, the results from one-way ANOVA revealed F=1.072, df=9, p=0.393>0.05, while for the scale of *hope based on denial*, F=1.368, df=9, p=0.218>0.05. In both cases, the null hypotheses could not be rejected. This suggests that the differences between major subjects were not significant for the two sub-scales of hope.

Furthermore, the individual items on the hope scale were examined to detect any significant differences among different major subjects of study. Again, one-way ANOVA tests were conducted on all twelve items on the hope scale, with major subjects of study as the independent variable. The results for all twelve items indicated that none of the items were statistically significant at a 95% confidence interval among different major subjects of study. These results suggest that there was insufficient evidence to claim that students in any specific subjects were more hopeful than others.

4.2.3.3 Comparison of hope by year of study

The subsequent analysis aimed to explore the variations of the hope scores among students in different years of study. To determine the significance of the variation of hope scores among different years of study, one-way ANOVA was employed on all twelve items on the hope scales, with year of study as the independent variable. The results indicated that only one item on the hope of denial scale was statistically significant at a 95% confidence level (F=2.610, df=4, p<0.05). The significant statement was Hd, "because I believe that climate change is natural

and I doubt that climate change is caused by emissions that we humans create." The mean score for this item among year three students was significantly lower (1.91) in comparison with other years (ranging from 2.28 to 3.5). As this item belonged to the hope of denial scale, it can be inferred that year three students were less likely to subscribe to the idea of denial of climate change. In contrast, year five students had a particularly high score of 3.5 for the same item, indicating that they were more likely to hold this type of denial. A post-hoc analysis utilizing Tukey's honest significant difference test confirmed that the difference between year three and year five students was statistically significant ($F=2.591$, $p<0.05$).

The following cross-table (Table 4.11) shows the response of this item Hd in each year of study.

Table 4.11

Distribution of Responses for Item Hd across Year of Study

Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.

	Year of Study					Total
	One	Two	Three	Four	Five	
0=Not at all	6	5	6	7	0	24
1	6	2	3	2	2	15
2	6	3	1	1	2	13
3	3	2	0	2	1	8
4	8	3	0	5	1	17
5	2	3	1	4	2	12
6=Very well	1	0	0	1	2	4
Total	32	18	11	22	10	93

These responses were arranged for easier observation by combining some of the responses into three groups. By combining 0 to 2 as "agree" and then 4 to 6 as "disagree", the above table was converted into 5 x 3 matrix as shown in Table 4.11a. A response of 3 was denoted as "neutral" in the table.

Table 4.11a

Distribution of Grouped Responses for Item Hd across Year of Study.

Response	Year of Study					Total
	One	Two	Three	Four	Five	
Disagree	18	10	10	10	4	52
Neutral	3	2	0	2	1	8
Agree	11	6	1	10	5	33
Total	32	18	11	22	10	93

As presented in Table 4.11a, the responses of students concerning this particular idea about climate change demonstrated significant yearly differences. With the exception of year three, approximately one third to half of the respondents agreed with the statement for each year of study. Conversely, for the year three sample, almost all the responses disagreed with the idea. This indicated that most of the year three students in the sample acknowledged that climate change is primarily caused by emissions from human activities.

The significance of this finding regarding the prevalence of climate change denial among the sample will be discussed in the next chapter. Additionally, we will also explore the potential reasons for this distribution pattern of response.

4.2.3.4 Hope by university level course with climate change

To investigate whether university-level courses could impact students' hope in climate change education, a comparison was made between the hope scale items of students who had reported learning about climate change in university courses and those who had not. The comparison of hope scores was shown in table 4.12. Independent sample t-tests were used to test for significant differences among each pair of the hope scores, with the university course in climate change serving as the grouping variable. The null hypothesis posited that the mean hope scores for the two groups of students were the same.

The findings revealed that none of the twelve items on the hope scale demonstrated significant differences at a 95% confidence interval between the two groups. Consequently, the null hypothesis could not be rejected. Given that the question only inquired whether students had learned about climate change from university courses, the present analysis suggested that university-level courses did not show notable effects on students' hope in climate change.

Similar results were obtained when the sub-scales of *constructive hope* and *hope based on denial* were employed to group the items on the scale and evaluated. Once again, independent sample t-tests were conducted on the two sub-scales, with participation in university courses on climate change serving as the grouping variable. The results indicated that for *constructive hope*, t=-0.880 and p>0.05, while for *hope based on denial*, t=-0.147 and p>0.05. In both cases, the differences between the two groups were not statistically significant at a 95% confidence interval. In conclusion, university courses that include climate change did not exhibit significant impacts on students' hope in climate change.

Table 4.12

Comparison of Hope between Students who Have Learnt about Climate Change in University

Course with Those who Have Not Had Such Learning Experience

	Learnt climate change in univ course?	N	Mean	Std. Deviation	Std. Error Mean
Ha. Because I believe that research and technical solutions will contribute to the improvement of the climate change problem.	N	40	3.55	1.45	0.23
	Y	53	3.64	1.33	0.18
Hb. Because I do not think that climate change is as big of a problem as certain researchers claim.	N	40	1.58	1.91	0.30
	Y	53	1.74	1.74	0.24
Hc. Because we as individuals can change our behavior, together we can influence climate change in a positive direction.	N	40	3.75	1.71	0.27
	Y	53	3.94	1.55	0.21
Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.	N	40	2.18	2.00	0.32
	Y	53	2.45	1.92	0.26
He. Because the awareness about this problem has increased considerably during recent years.	N	40	3.80	1.38	0.22
	Y	53	3.96	1.27	0.17
Hf. Because politicians in more and more countries take climate change seriously.	N	40	3.00	1.52	0.24
	Y	53	3.58	1.41	0.19
Hg. Because ultimately we will be forced to take climate problems seriously and to take our responsibility.	N	40	3.53	1.55	0.25
	Y	53	3.94	1.51	0.21
Hh. Because I doubt that there is any change in the climate.	N	40	2.03	1.75	0.28
	Y	53	1.79	1.67	0.23
Hi. Because as long as there are people who are active in environmental organizations there is a possibility that the climate issue will be solved.	N	40	2.73	1.55	0.25
	Y	53	2.98	1.45	0.20
Hj. Because I know that there are a number of things that I myself can do to contribute to the improvement of the climate change problem.	N	40	3.65	1.23	0.19
	Y	53	3.60	1.47	0.20
Hk. Because I try to focus on positive news about climate change in the media.	N	40	2.53	1.40	0.22
	Y	53	2.45	1.56	0.21
Hl. Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change.	N	40	1.43	1.87	0.30
	Y	53	1.40	1.60	0.22

4.2.3.5 Comparison of hope by gender

It was pertinent to explore whether there exist any substantial gender differences in the hope towards climate change. To achieve this objective, the samples were grouped based on gender, and their mean scores for each item on the hope scales were compared. The results were presented in Table 4.13.

Table 4.13

Comparison of Hope Scale Item between Genders

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Ha. Because I believe that research and technical solutions will contribute to the improvement of the climate change problem.	Male	33	3.85	1.503	0.262
	Female	60	3.47	1.295	0.167
Hb. Because I do not think that climate change is as big of a problem as certain researchers claim.	Male	33	2.06	1.870	0.325
	Female	60	1.45	1.751	0.226
Hc. Because we as individuals can change our behavior, together we can influence climate change in a positive direction.	Male	33	3.45	1.716	0.299
	Female	60	4.08	1.522	0.196
Hd. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.	Male	33	2.52	2.048	0.357
	Female	60	2.23	1.899	0.245
He. Because the awareness about this problem has increased considerably during recent years.	Male	33	3.85	1.523	0.265
	Female	60	3.92	1.197	0.155
Hf. Because politicians in more and more countries take climate change seriously.	Male	33	3.33	1.534	0.267
	Female	60	3.33	1.457	0.188
Hg. Because ultimately we will be forced to take climate problems seriously and to take our responsibility.	Male	33	3.45	1.523	0.265
	Female	60	3.93	1.528	0.197
Hh. Because I doubt that there is any change in the climate.	Male	33	2.36	1.747	0.304
	Female	60	1.63	1.626	0.210
Hi. Because as long as there are people who are active in environmental organizations there is a possibility that the climate	Male	33	3.21	1.556	0.271
	Female	60	2.68	1.432	0.185
Hj. Because I know that there are a number of things that I myself can do to contribute to the improvement of the climate change problem.	Male	33	3.42	1.275	0.222
	Female	60	3.73	1.413	0.182
Hk. Because I try to focus on positive news about climate change in the media.	Male	33	2.85	1.564	0.272
	Female	60	2.28	1.415	0.183
Hl. Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change.	Male	33	1.82	1.704	0.297
	Female	60	1.18	1.682	0.217

Upon a cursory examination of Table 4.13, it was evident that there were notable differences in the scores of each item between the two genders. It was therefore crucial to determine whether these observed differences are statistically significant via independent sample t-tests. The results indicated that the difference in one single item, Hh, "because I doubt that there is any change in the climate," is indeed significant at a 95% confidence interval (t=2.019, df=91,

p=0.046). Male students scored higher than female students on this item from the hope of denial sub-scale.

For the two sub-scales, independent sample t-tests were also employed to ascertain if there were any significant differences between the two genders. The results of the test for both the *constructive hope* scale (t=-0.005, df=91, p=0.996) and *hope based on denial* (t=1.839, df=91, p=0.069) indicated a p-value greater than 0.05. Therefore, for both sub-scales, neither of these two sub-scales exhibited significant differences between the two genders among the samples.

Summarizing the comparisons of hope between different groups above, there were a few significant differences observed. Perhaps, the most notable observation was the year- by-year variation of a specific erroneous idea (Hd) that was tied to the *hope based on denial* (4.2.3.3). As revealed previously, the erroneous idea was that climate change is natural, while also casting doubt about emission caused by human activities being the main cause. This idea had a significant presence among our sample. As the present analysis showed the year of study as a significant factor, we will discuss possible factors that contribute to such variations in next chapter.

4.2.3.6 Comparison of emotions with different types of hope

To address research question RQ1d, we aimed to investigate how different types of hope affected the emotions of students from the survey data. Based on the data from survey, we also wanted to explore any linkages between the two hope subscales and perceived teachers' attitudes in communication. Ideally, we should divide the respondents into two groups based on their hope scores, with one group having high *constructive hope* and the other having high *hope based on the denial* of climate change. However, as the two types of hope were measured

on different scales this was not quite feasible in our current data. This was demonstrated in a scatterplot of *hope_positive* versus *hope_denial* in Figure 6. It was observed that respondents who have higher *hope based on denial* also scored quite well on the *constructive hope* scale. As shown in Figure 6, the respondents with high scores of *hope_denial* substantially overlapped with those with high *hope_positive*. It was further observed that virtually all the data points were in the lower triangular region. In our current samples, there were no respondents in the samples who had high *hope_denial* score but low score in *hope_positive*. When Spearman's rho correlation between *constructive hope* (*hope_positive*) and *hope based on denial* (*hope_denial*) was calculated, a value of rho 0.472 was obtained with $p < 0.001$. It showed the correlation between the two values were moderate and significant.

Figure 6

Scatter Plot of hope_positive vs hope_denial, Corresponding to Constructive Hope and Hope Based on Denial Respectively.
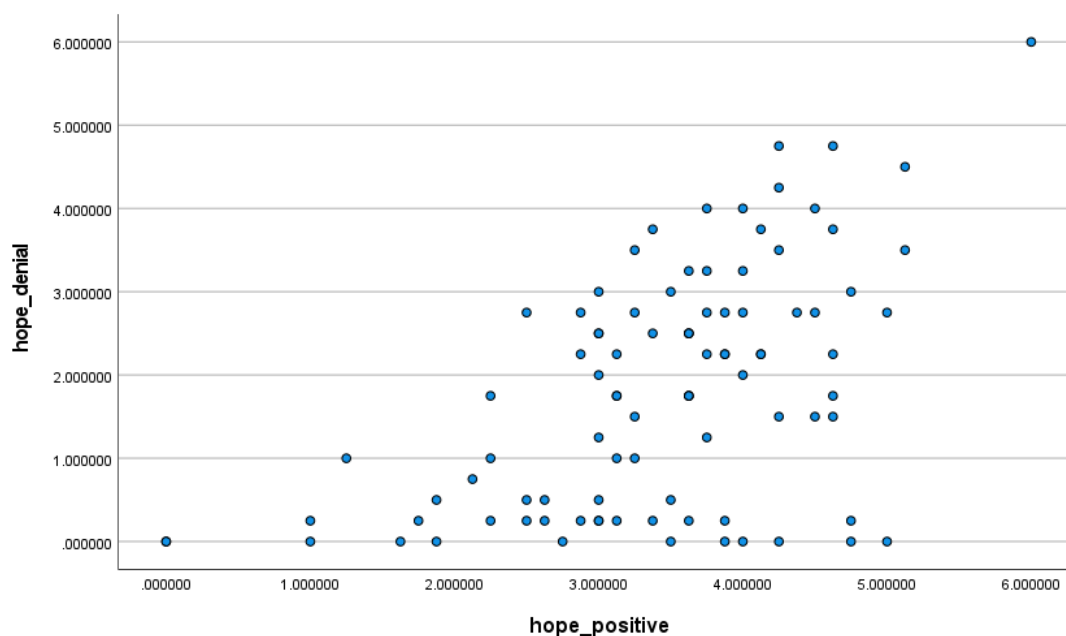
Based on these data, a grouping was suggested by the researcher based on the two hope subscales. Using the middle value of 3.0 as the division line between high and low scores of both *hope_positive* and *hope_denial*, the following three groups of online survey data were formed based on the two types of hope:

G1: *hope_positive* > 3.0 and *hope_denial* < 3.0

G2: *hope_positive* > 3.0 and *hope_denial* > 3.0

G3: *hope_positive* < 3.0 and *hope_denial* < 3.0

The number of respondents in the three groups G1, G2, and G3 were 44, 17, and 22, respectively. The remaining ten respondents were located on the boundaries of the groupings, with either *hope_positive* or *hope_denial* equal to 3.0. For the purpose of comparisons among the three hope-based groups, these ten samples located on the boundaries were not included.

Defined in this manner, the three groups corresponded to three combinations of hope towards climate change. Group G1 corresponded to students with high *constructive hope* but low *hope based on denial*, hence labeled as "realistic hope". Group G2 corresponded to students with high *constructive hope* and high *hope based on denial*, thus labeled as "mixed hope." Group G3 corresponded to students with relatively low scores in both types of hope, hence labeled as "low hope".

It should be emphasized that this contingent grouping was based on the mean scores of the subscale, and therefore may not be very accurate for reflecting students' alignment with individual items on the hope scale. Nevertheless, this grouping provided a convenient basis for us to compare between students with different combinations of the two types of hope using statistical analysis.

4.2.3.7 Influence of different types of hope on emotions

Sub-question 1d (RQ1d):

In what ways do students' hope in climate change affect their emotions to climate change?

We can use the above grouping based on hope to explore the emotions of students facing climate change, as shown in Figure 7. It can be observed that some of the emotions exhibited considerable differences among the three groups. The statistical significances of these differences were checked with one-way ANOVA, using grouping by hope as the factor. It was then observed that the differences were significant for the following four emotions: determined ($F=6.958$, $p<0.01$), hopeful ($F=6.548$, $p<0.01$), concerned ($F=4.902$, $p<0.01$), joyful ($F=3.644$, $p<0.05$). The corresponding mean scores for these emotions were shown in Table 4.14. It can be readily observed that in all four emotions, the group with low hope G3 showed lower scores in these four emotions. However, it was premature to suggest that respondents in G3 will show lower intensity in all emotions. As observed in Figure 6, the mean scores of emotions in G3 vary when compared to G1 and G2. Post-hoc analysis with Turkey's HSD tests confirmed mean scores in G3 were significantly lower than G2 in these four emotions ($p<0.01$ for determined, $p<0.05$ for hopeful, concerned, and joyful). Likewise, mean scores in G3 were also lower than G1 in emotions of hopeful ($p<0.01$) and concerned ($p<0.05$). While other emotions also showed some observable differences in different directions in Figure 6, they were not significant statistically. With the existing evidence available, it was prudent to say that students with different hope about climate change also exhibited distinct emotions to it. The significance of this relationship between hope and emotions will be discussed in the next chapter.

Table 4.14

Emotions that Are Significantly Different among Three Groups with Different Hope

		Determined	Hopeful	Concerned	Joyful
G1	Mean	3.36	2.61	3.98	1.64
	N	44	44	44	44
	Std. Deviation	0.75	0.945	0.698	0.892
G2	Mean	3.88	2.53	4.06	2.00
	N	17	17	17	17
	Std. Deviation	0.857	1.007	0.748	1.173
G3	Mean	2.82	1.77	3.24	1.23
	N	22	22	22	22
	Std. Deviation	1.14	0.752	1.48	0.612

Figure 7
Comparison of Emotions Based on Group by Hope
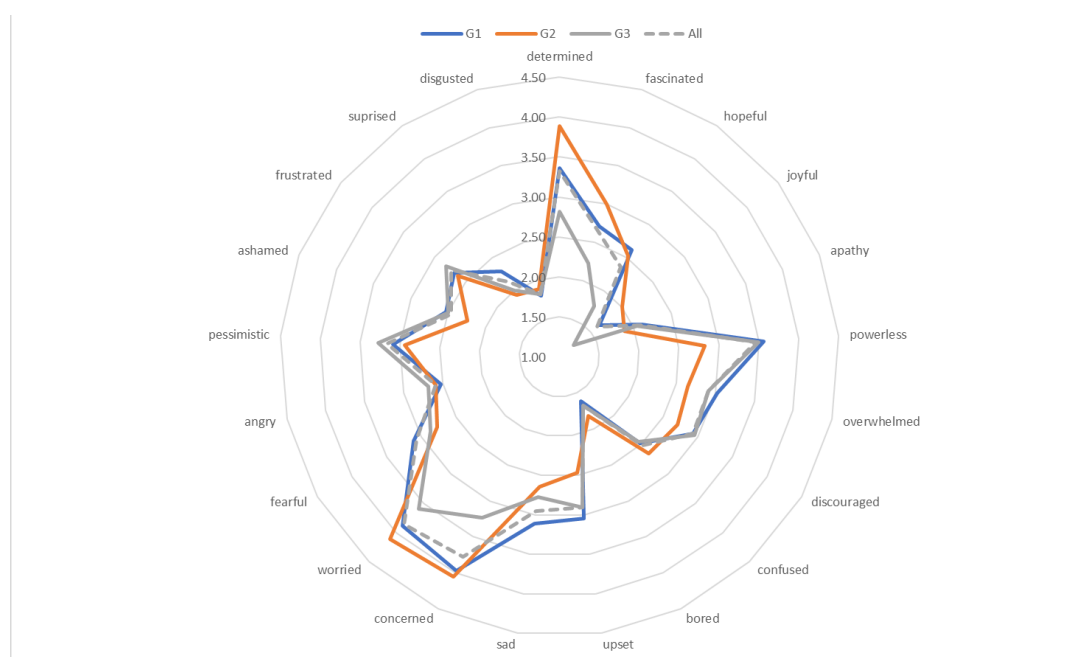
4.2.4 Perceived teacher's attitude in communication

The subsequent section of the statistical analysis focused on the students' responses regarding their perceptions of teachers' attitudes in communication. As mentioned in previous chapter, there are two groups of eight statements used to assess perceived teachers' attitudes in both universities and secondary schools in the past. Each group of eight statements on the scale was divided into two subgroups. The first subgroup comprised the five positive descriptions about perceived teachers' attitudes in communication (Ua to Ue and SSa to SSe). The means of these were represented by U_positive and SS_positive for university and secondary schools, respectively. The remaining three statements (Uf to Uh and SSf to SSh) constituted the negative descriptions about perceived teachers' attitudes. The means of these were labeled as U_negative and SS_negative, respectively, in the table.

The distribution of students' responses to this section was presented in Tables 4.15a and 4.15b, with all items measured on a scale of 0 to 6.

Table 4.15a

Distribution in Perceived University Teachers' Attitudes in Communication

	Mean	N	Std. Deviation	Std. Error of Mean
Ua. I have teachers who take up things that are being done to alleviate various societal and environmental problems, such as political or scientific progress.	2.87	86	1.71	0.18
Ub. I have teachers who talk about societal and environmental issues in an involved and thought-provoking way.	3.03	86	1.69	0.18
Uc. I have teachers who take up how you as a young person can alleviate various societal and environmental problems.	3.15	86	1.67	0.18
Ud. There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me.	2.81	86	1.60	0.17
Ue. I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future.	3.02	85	1.68	0.18
Uf. Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues.	2.29	86	1.65	0.18
Ug. Most of my teachers often convey an extremely negative and gloomy picture of the future when they talk about societal and environmental issues.	2.16	86	1.64	0.18
Uh. When it comes to societal and environmental issues, most of my teachers talk almost exclusively about all the terrible things that are happening in the world.	2.19	86	1.56	0.17
U_positive	2.98	85	1.53	0.17
U_negative	2.21	86	1.51	0.16

Table 4.15b

Distribution in Perceived Teachers' Attitudes in Secondary School

	Mean	N	Std. Deviation	Std. Error of Mean
SSa. I have teachers who take up things that are being done to alleviate various societal and environmental problems, such as political or scientific progress.	3.08	88	1.56	0.17
SSb. I have teachers who talk about societal and environmental issues in an involved and thought-provoking way.	3.48	88	1.52	0.16
SSc. I have teachers who take up how you as a young person can alleviate various societal and environmental problems.	3.58	88	1.42	0.15
SSd. There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me.	3.34	88	1.51	0.16
SSe. I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future.	3.70	88	1.42	0.15
SSf. Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues.	2.22	88	1.62	0.17
SSg. Most of my teachers often convey an extremely negative and gloomy picture of the future when they talk about societal and environmental issues.	2.41	88	1.59	0.17
SSh. When it comes to societal and environmental issues, most of my teachers talk almost exclusively about all the terrible things that are happening in the world.	2.66	88	1.55	0.17
SS_positive	3.44	88	1.26	0.13
SS_negative	2.43	88	1.43	0.15

The results in these two tables demonstrated that the perceived teachers' attitudes in communication regarding environmental and social issues were relatively moderate. The mean scores of the items concerning perceived positive attitudes of teachers (Ua to Ue and SSa to SSe) ranged between 2.81 to 3.7 out of a maximum of 6.

Regarding the perceived teachers' attitudes in university, the mean scores of the positive statements ranged between the lowest value of 2.81 and the highest value of 3.15. The statement

with the highest mean was "Uc. I have teachers who take up how you as a young person can alleviate various societal and environmental problems." Conversely, the statement with the lowest mean was "Ud. There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me." The mean scores of the three negative statements about perceived teachers' attitudes in university ranged between 2.16 and 2.29, indicating relatively low agreement with the statements.

For the perceived teachers' attitudes in secondary school, the mean scores of the positive statements ranged between 3.08 and 3.70, which were comparatively higher than the corresponding mean scores for university in the previous paragraph. The statement with the highest mean was "SSe. I have teachers who talk about societal and environmental problems in the classroom and indicate possible ways to solve those problems in the future." In contrast, the statement with the lowest mean was "SSa. I have teachers who take up things that are being done to alleviate various societal and environmental problems such as political or scientific progress." The mean scores of the three negative statements ranged between 2.22 and 2.61, implying relatively lower agreement with the statements.

Additional evidence about the effectiveness of existing climate change education in university can be obtained from the survey results, by examining how students perceived their learning about climate change in university-level courses. To achieve this, we compared the responses of students who had learned about climate change in a university-level course with those who did not have such learning experiences. Differences observed between these two groups may be partially attributed to their learning experiences in relevant courses with learning experience related to climate change. The results of this comparison may be presented in Table 4.16.

Table 4.16

Perceived Teachers' Attitudes in items with Significant Differences as Identified by t-test, with

Learning about Climate Change in University Course as Factor

	Learnt about climate change in uni course	N	Mean	Std. Deviation	Std. Error Mean	t	Significant?
Ua. I have teachers who take up things that are being done to alleviate various societal and environmental problems, such as political or scientific progress.	N	37	2.08	1.67	0.28	-4.04	y***
	Y	49	3.47	1.50	0.21		
Ub. I have teachers who talk about societal and environmental issues in an involved and thought-provoking way.	N	37	2.19	1.66	0.27	-4.46	y***
	Y	49	3.67	1.42	0.20		
Uc. I have teachers who take up how you as a young person can alleviate various societal and environmental problems.	N	37	2.27	1.56	0.26	-4.76	y***
	Y	49	3.82	1.44	0.21		
Ud. There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me.	N	37	2.05	1.56	0.26	-4.19	y***
	Y	49	3.39	1.38	0.20		
Ue. I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future.	N	36	2.17	1.63	0.27	-4.45	y
	Y	49	3.65	1.44	0.21		
Uf. Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues.	N	37	1.86	1.51	0.25	-2.12	y*
	Y	49	2.61	1.69	0.24		
Ug. Most of my teachers often convey an extremely negative and gloomy picture of the future when they talk about societal and environmental issues.	N	37	1.73	1.37	0.22	-2.18	y*
	Y	49	2.49	1.76	0.25		
Uh. When it comes to societal and environmental issues, most of my teachers talk almost exclusively about all the terrible things that are happening in the world.	N	37	1.95	1.49	0.24	-1.24	n
	Y	49	2.37	1.60	0.23		
U_positive	N	36	2.13	1.53	0.25	-4.79	y***
	Y	49	3.60	1.20	0.17		
U_negative	N	37	1.85	1.39	0.23	-1.99	y*
	Y	49	2.49	1.55	0.22		

* $p<0.05$ ** $p<0.01$ *** $p<0.001$

The results in table 4.16 revealed that for all items on perceived teachers' attitudes in

university (Ua to Uh), the mean scores were higher for students who had learned about

climate change in some university courses. Upon conducting independent sample t-tests to

determine the significance of the differences between these two groups of students, our

observations were confirmed. Out of the eight items concerning perceived university

teachers' attitudes in communication, the differences in seven items were statistically

significant at a 95% confidence interval. The only item on the scale that was not significant

was Uh, "When it comes to societal and environmental issues, most of my teachers talk

almost exclusively about all the terrible things that are happening in the world."

The eight items were divided into two subscales, each with 4 items, with one group for positive attitudes (*U_positive*) and the other for negative attitudes (*U_negative*), we can once again compare the two groups of students based on whether they had learned about climate change in university. The results, as presented in the same 4.16 table, were quite clear. Concerning their teachers' attitudes in communication about societal and environmental issues, the two groups of students held distinct perceptions. For students who had learned about climate change in university-level courses, they tended to agree more strongly with both positive and negative descriptions of perceived teachers' attitudes. Such analysis shows that students enrolled in these courses were well aware of teachers' efforts in communicating about environmental and social issues in the university.

4.2.4.1   Relationship between hope and perceived teachers' communication style

The next part of the analysis was about how students with different types of hope towards the future of climate change perceived teacher's communication styles, which was asked in last sub-question of first research question RQ1e.

Utilizing the grouping based on emotions, we can compare the perceived teachers' attitudes in communication to determine if there were any significant differences. The results of this analysis were presented in Table 4.17a.

Table 4.17a

Comparison of Perceived Teachers' Attitudes in Communication in Secondary Schools with Grouping Based on Two Types of Hope

		SSa	SSb	SSc	SSd	Sse	SSf	SSg	SSh	SS_positive	SS_negative
G1	Mean	3.26	3.88	3.95	3.52	3.98	1.93	2.38	2.60	3.72	2.30
	N	42	42	42	42	42	42	42	42	42	42
	Std. Deviation	1.62	1.29	1.25	1.50	1.33	1.47	1.56	1.58	1.15	1.39
G2	Mean	3.56	3.94	3.94	4.19	4.25	3.13	3.06	3.31	3.98	3.17
	N	16	16	16	16	16	16	16	16	16	16
	Std. Deviation	1.31	1.65	1.53	1.47	1.34	1.71	1.77	1.82	1.25	1.66
G3	Mean	2.68	2.59	2.82	2.59	2.82	1.86	2.09	2.32	2.70	2.09
	N	22	22	22	22	22	22	22	22	22	22
	Std. Deviation	1.64	1.62	1.50	1.44	1.50	1.67	1.63	1.46	1.32	1.38
	significance	$p>0.05$	$**p<0.01$	$**p<0.01$	$**p<0.01$	$**p<0.01$	$*p<0.05$	$p>0.05$	$p>0.05$	$**p<0.01$	$p>0.05$

Upon examination of Table 4.17a, it was apparent that there were pronounced disparities in the perceived teachers' attitudes in communication among the three groups. To determine if the observed differences among these groups were significant, we conducted one-way ANOVA tests with grouping based on hope (g) as the factor. The results show that the three groups were significantly different in four of the positive statements (SSb, SSc, SSd, SSe) and one of the negative statements (SSf).

More specifically, the mean scores of the following four positive statements for G1 and G2 were significantly higher than G3.

SSb. "I have teachers who talk about societal and environmental issues in an involved and thought-provoking way."

SSc. "I have teachers who take up how you as a young person can alleviate various societal and environmental problems."

SSd. "There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me."

SSe. "I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future."

Regarding the negative statement SSf, the mean score of G2 was higher than both G1 and G3 for the following statement. "Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues."

For the comparison of perceived university teacher's attitudes in communication, the data are shown in table 4.17b.

Table 4.17b

Comparison of Perceived Teachers' Attitudes in Communication in University, Grouping Based on Two Types of Hope

		Ua	Ub	Uc	Ud	Ue	Uf	Ug	Uh	U_positive	U_negative
G1	Mean	2.90	3.29	3.46	3.05	3.29	2.17	2.00	1.93	3.20	2.03
	N	41	41	41	41	41	41	41	41	41	41
	Std. Deviation	1.73	1.76	1.60	1.55	1.71	1.72	1.53	1.49	1.47	1.51
G2	Mean	3.31	3.19	3.25	3.19	3.44	3.06	3.06	2.81	3.28	2.98
	N	16	16	16	16	16	16	16	16	16	16
	Std. Deviation	1.92	1.80	1.77	1.64	1.75	1.77	1.88	1.87	1.70	1.72
G3	Mean	2.57	2.48	2.67	2.05	2.38	1.95	2.00	2.43	2.43	2.13
	N	21	21	21	21	21	21	21	21	21	21
	Std. Deviation	1.72	1.57	1.77	1.63	1.50	1.50	1.55	1.50	1.52	1.38
	Significance	$p>0.05$	$p>0.05$	$p>0.05$	$*p<0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$

To investigate the perceived teachers' attitudes in communication in university, we utilized one-way ANOVA with grouping based on hope as a factor for the eight items Ua to Uh. The results were presented in Table 4.17b, which indicated that the differences in mean scores were only significant for one item, Ud: "There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me." For this item, we observed that both G1

and G2 had higher scores than G3. In comparison to the previous comparison about perceived teachers' attitudes in secondary schools, the differences among these three groups based on hope were less observable for their perceived teachers' attitudes in university.

Based on the above analysis, we can address research sub-question RQ1e.

Sub-question RQ1e:

In what ways do students' hope in climate change affect how students perceived communication style of teachers in the past?

To summarize the above analysis, it was evident that students with higher hope in the future of climate change (group G1 and G2) tended to perceive their past learning experiences in secondary school more positively than those with low hope (G3). This applied not only to *constructive hope* but also to *hope based on denial of climate change*. However, students with mixed hope (G2) also tended to perceive most teachers in secondary school focused primarily on how hopeless everything was when they talked about societal and environmental issues.

In comparison, students with a varied combination of hope in the future of climate change did not show significant differences in perceiving their teachers' communication style in university. However, students with both *constructive hope* and *hope based on denial* were more likely to notice their teachers talking about societal and environmental issues in a way that awakened their positive emotions.

4.2.5 Summary of the relationship between hope and emotion

After addressing all the sub-questions of first research question, we can answer the first research question about the relationship between hope and emotions when students facing climate change.

RQ1: What is the relationship between hope and emotions to climate change among students of Bachelor of Education programme?

The findings of this study revealed that more than half of the undergraduate students surveyed felt concerned and worried but powerless about climate change. Other emotions, such as pessimism, determination, and fear, were found to be slightly less common among the same population.

Regarding differences among students from different years of study, it was observed that the emotion of powerlessness varied significantly. Specifically, senior students reported feeling a stronger sense of powerlessness than junior students.

Gender differences were found to be significant for only two emotions, with female students reporting feeling more *upset* and *sadness* about climate change than male students. Apart from this, no noticeable differences were observed among students from different major areas of study. When comparing the emotions to climate change between students who had studied climate change in university and those who had not, it was found that the former group reported slightly more positive emotions than the latter.

While it was observed that *constructive hope* towards the future of climate change was more common than *hope based on denial* among university students surveyed, it was also observed that some ideas tied to *hope based on denial of climate change* had a considerable presence, with over one third of survey students having doubt about the linkage between climate change and human activities.

Regarding to the influence of hope on emotions, it was observed that students with different combinations of hope on climate change displayed some notable differences in emotions towards the future of climate change. The differences were significant for the following emotions: determined, hopeful, concerned, joyful. Students with lower hope (group G3) were also less likely to report these four emotions than students with higher hope (group G1 and G2).

It was further observed that hope in climate change can have significant influence on how students perceived teachers' communication style in the past. It was evident that students with higher hope in the future of climate change (group G1 and G2) tended to perceive their past learning experiences in secondary school more positively than those with low hope (G3). However, students with mixed hope (G2) also tended to perceive most teachers in secondary school focused primarily on how hopeless everything was when they talked about societal and environmental issues. The effects of hope on how students perceive their learning experience in university was much less noticeable. However, students with higher hope in both *constructive hope* and *hope based on denial* were more likely to notice their teachers talking about societal and environmental issues in a way that awakened their positive emotions.

4.3   The interview

In the following section, we examined the findings from the interviews and used the data to answer our second research question (RQ2). By doing so we were studying how hope about future of climate change are related to past learning experience about climate change. We will begin by providing a description of the backgrounds of the interviewees from the survey data.

4.3.1 Backgrounds of interviewees

Ten Bachelor of Education students were invited to participate in the interview. Table 4.18

presented the profile of the participants' background information. It was notable that there were no students in the first and final year of study, as none of the surveyed students in these years provided their consent to be interviewed. While this limitation may affect the representativeness of the sample, it was acknowledged and accepted.

Table 4.18

Background Information of the Interviewees

Interviewee	Major_area	Minor_area	Gender	Year of study	CCE in university?
1	Mathematics (Secondary)	Science	Female	2	No
2	Chinese Language	/	Female	3	Yes
3	Geography	Liberal Studies	Male	2	Yes
4	Science	/	Male	2	No
5	Creative Arts and Culture & Visual Arts Education	/	Female	4	No
6	Language Studies & English Education	/	Female	4	Yes
7	Geography	/	Male	3	Yes
8	English Language	/	Male	4	No
9	Creative Arts and Culture & Visual Arts Education	/	Female	4	No
10	Chinese Language	General Studies	Female	2	No

4.3.1.1 Emotional profiles of the interviewees

The table 4.19a and table 4.19b showed the emotional profiles of all the interviewees.

Table 4.19a *Emotional Profiles of the Interviewees*

	←	E1		→	←	E2				→
interviewee	determined	fascinated	hopeful	joyful	apathy	powerless	over-whelmed	discouraged	confused	bored
Interviewee 01	4	3	1	1	4	5	2	4	2	1
Interviewee 02	2	2	2	1	3	4	2	2	2	1
Interviewee 03	4	2	3	1	3	4	3	4	3	2
Interviewee 04	4	4	3	1	2	2	2	2	2	1
Interviewee 05	5	3	2	1	1	2	1	1	3	1
Interviewee 06	4	2	3	1	2	4	3	4	2	1
Interviewee 07	4	3	2	1	2	3	2	3	1	1
Interviewee 08	3	4	4	2	3	5	5	5	2	1
Interviewee 09	3	1	3	1	3	3	4	3	3	2
Interviewee 10	3	3	2	2	2	3	4	3	3	2

Table 4.19b *Emotional Profiles of the Interviewees (Cont.)*

| Interviewee | ← | | E3 | | | → | ← | | E4 | | → |
	upset	sad	concerned	worried	fearful	angry	pessimistic	ashamed	frustrated	surprised	disgusted
Interviewee 01	4	3	3	4	5	2	5	2	4	2	2
Interviewee 02	2	2	3	3	2	2	2	2	3	1	1
Interviewee 03	3	2	4	4	3	1	4	3	4	5	1
Interviewee 04	2	3	4	4	3	2	2	2	2	2	2
Interviewee 05	1	2	5	4	3	4	1	1	2	1	1
Interviewee 06	3	3	5	5	1	1	2	1	2	1	1
Interviewee 07	4	2	5	5	4	3	2	1	3	1	1
Interviewee 08	5	4	4	4	4	4	5	3	4	4	3
Interviewee 09	3	4	4	4	2	3	4	1	3	2	1
Interviewee 10	4	3	4	4	2	3	3	3	3	2	2

It was observed that some emotions were less frequently expressed by the participants, such as *joyful* and *bored*. Conversely, certain emotions were more prevalent and stronger among the interviewees. Notably, all interviewees scored at least 3 or above in feeling *concerned* and *worried* about climate change. These scores largely mirrored the overall sentiments of the surveyed students. The responses to other emotions were more varied.

It is worth noting that some interviewees reported stronger emotions than others. For example, Interviewee 08 revealed relatively strong feelings (4.0 or higher) across many of the listed emotions, indicating that this individual was more emotionally invested in the issue of climate change. In contrast, Interviewee 02 only expressed one stronger emotion, which was *powerlessness*.

Table 4.19c

Means of the Emotions in Four Subgroups of Interviewees

Interviewee	E1	E2	E3	E4
Interviewee 01	2.25	3.00	3.50	3.00
Interviewee 02	1.75	2.33	2.33	1.80
Interviewee 03	2.50	3.17	2.83	3.40
Interviewee 04	3.00	1.83	3.00	2.00
Interviewee 05	2.75	1.50	3.17	1.20
Interviewee 06	2.50	2.67	3.00	1.40
Interviewee 07	2.50	2.00	3.83	1.60
Interviewee 08	3.25	3.50	4.17	3.80
Interviewee 09	2.00	3.00	3.33	2.20
Interviewee 10	2.50	2.83	3.33	2.60

As discussed in the previous chapter, the 21 emotions can be grouped into four categories based on their potential implications for individual actions, as presented in Table 4.19c. E1 corresponded to positive emotions, E2 corresponded to negative emotions with potential implications for inaction, E3 corresponded to negative emotions with potential implications for action, and E4 corresponded to negative emotions with no clear implications for action. It was postulated that respondents with lower scores in E2 or higher scores in E3 may be more likely to engage in climate actions, while the reverse may also be possible. Higher mean scores in E2 or lower scores in E3 suggested that the respondent was less likely to engage in climate actions. The implications of E1 and E4 for climate action were less clear but may still indicate a general emotional investment in climate change.

When we presented the emotions in this manner, we can observe a diversity of emotion patterns among interviewees. Some interviewees appeared to show generally stronger emotions across multiple categories of emotions. Specifically, data from Interviewee 08 indicated noticeably stronger emotional engagement across all four categories of emotions, with his mean scores

above 3.0. This contrasted with Interviewee 02, who demonstrated weak responses across all four categories, with mean scored below 2.5 in all four categories.

To gain a more comprehensive perspective on the emotions of the various interviewees, we presented the scores of the various subscales introduced in the previous section for all ten interviewees in Table 4.20.

Table 4.20

Emotions, Hope and Perceived Attitudes of Teachers of Interviewees

Interviewee	E1	E2	E3	E4	hope_positive	hope_denial	SS_positive	SS_negative	U_positive	U_negative
Interviewee 01	2.25	3.00	3.50	3.00	4.00	1.25	3.60	3.67	4.00	2.67
Interviewee 02	1.75	2.33	2.33	1.80	3.25	1.25	3.80	3.33	4.60	4.33
Interviewee 03	2.50	3.17	2.83	3.40	5.50	2.50	4.80	4.00	4.80	4.00
Interviewee 04	3.00	1.83	3.00	2.00	6.00	1.00	7.00	1.00	2.00	1.00
Interviewee 05	2.75	1.50	3.17	1.20	4.75	4.25	5.40	1.33	3.00	3.00
Interviewee 06	2.50	2.67	3.00	1.40	4.88	1.00	6.20	1.67	4.80	1.00
Interviewee 07	2.50	2.00	3.83	1.60	3.75	1.00	4.20	2.00	5.20	1.67
Interviewee 08	3.25	3.50	4.17	3.80	5.00	1.00	missing	missing	missing	missing
Interviewee 09	2.00	3.00	3.33	2.20	4.75	3.75	4.40	4.33	3.60	3.33
Interviewee 10	2.50	2.83	3.33	2.60	4.13	2.75	2.60	1.00	2.40	1.00

Table 4.20 revealed that all ten interviewees scored higher on *constructive hope* (*hope_positive*) than on *hope based on denial* (*hope_denial*). Consistent with the analysis of survey data, the interviewees were classified into three distinct groups based on their hope scores. The first group (G1) comprised interviewees 03, 04, 06, 08, and 10, who had relatively high scores in *constructive hope* and very low scores on *hope based on denial*. The second group (G2) includes interviewees 05 and 09, who had high scores in both types of hope. It is worth noting that while Interviewee 09's *hope_denial* score was less than 3.0, her scores for two of the items on *hope based on denial* were quite high. Her scores for items Hb, Hd, Hh, and Hl were 4, 4, 2, and 1, respectively. That was the reason Interviewee 09 was classified as G2 ("mixed hope") rather than G1 ("realistic hope").

The third group (G3) consisted of interviewees 02 and 07, who had lower scores of *constructive hope* and low scores in *hope based on denial*. Lastly, Interviewee 01 did not fall into these three groups as her *hope_positive* score of 3.0 fell on the boundary between G1 and G3.

By grouping the interviewees in this way, we can explore how students with different emotions and hope levels described their past learning experiences regarding climate change.

4.3.1.2 Overview of writing task data

Additional data regarding the emotions and feelings associated with climate change were obtained through a writing task included in the first round of the online survey conducted in early 2021, as discussed in the previous chapter. Respondents were prompted to write about their feelings about the future of climate change. A total of 47 valid responses were collected from the students, with eight of these responses originally written in Chinese and then translated by the researcher for further analysis. The length of the messages is summarized in Table 4.21.

Table 4.21

Word Count Distribution of the Writing Tasks

Word count	Number of responses
1	7
2 to 10	6
11 to 20	14
21 to 30	7
31 to 40	3
41 to 50	3
over 51	7

Upon analyzing all of the written responses, several emotions and feelings were repeatedly

mentioned by the respondents. The most mentioned emotions were "worry" or "worried," which were found in 14 of the responses. The second most frequently mentioned emotion was "sad," which was mentioned by six respondents. Additionally, there were several emotions that were each mentioned by a single respondent, including "upset," "depressed," and "nervous."

Interestingly, seven of the responses consisted of only a single word, such as "worry" (2), "sad" (1), "afraid" (1), "urgent" (1), "unavoidable" (1), and "good" (1). The analysis results are shown in following table 4.22.

Table 4.22
A List of More Common Emotions Mentioned in the Writing task

Words or phases	Count
"worry" / "worried"	14
"sad"	6
"urgent"	3 *
"good"	2
"helpless"/"powerless"/"hopeless"	3 #

Note: * includes one response saying it is "not urgent"
　　　# include one of the translated responses

Seven out of the ten interviewees had also contributed to the pool of data for the writing task included in the first round of the online survey. These interviewees were numbered 01, 02, 03, 05, 06, 09, and 10.

As the question of the writing task was very similar to the interview data, the data from the writing task will be included in the analysis of how the students felt about climate change in the following section.

4.3.2 How students feel about climate change

The subsequent observations were derived from thematic analysis of the qualitative data from interview transcripts and writing task. Such analysis was required for understanding how students with different hope described future of climate change, as required for answering research sub-question RQ2a.

In addition to how students described the impact of climate change locally and globally, the following analysis also included how they perceived their personal linkages with climate change. It was postulated that such analysis was consistent with the objectives of the current research and necessary for suggesting curriculum innovation and provided a more comprehensive description about the role of hope in the learning process.

4.3.2.1 Theme: descriptions about the future of climate change

As the analysis of the online survey revealed that a significant proportion of surveyed students expressed concern about climate change, it was then not surprising that a similar trend can be observed among the respondents of the writing task, with 37 out of the 47 collected responses express a negative view describing the future of climate change.

One example of such a negative view is elaborated in the following response: "I feel not optimistic about climate change. I think the problem is getting worse due to the fast development of technology and increased human needs. It seems that luxury life is not sustainable at all and the resources will be used up soon. I think the Earth is not suitable for human to live after the next few generations. I feel that even though I try to do something to reduce the impact of climate change, like recycle and save energy, the effect is so small that cannot compensate the usage of energy or resources." (Response of writing task, interviewee 01)

In contrast to Interviewee 01's response during the interview regarding her feelings about climate change, her written response was more detailed. It demonstrated that she perceived climate change as a serious issue and acknowledged that her actions were insufficient in response.

One of the more unexpected written responses was provided by Interviewee 02, who composed an entire paragraph detailing various impacts of climate change.

"I feel *powerless/hopeless* about climate change. It is because it is not the first day we touch on this issue. However there is not much significant progress in so many years…..(It is followed by various impacts of climate change)… But even with all these changes, the international community or even myself still feel nothing can be done. *It is a worrying situation.*" (translated from written response of interviewee 02, G3)

Interviewee 02's elaborated written response contrasted with her weak emotional engagement in the issue, as evidenced by her low mean scores of self-reported emotions, as shown in table 4.19a and table 4.19b. This example highlighted how respondents could discuss climate change at length without being emotionally invested in the topic. If self-reported emotions served as an indicator of whether respondents considered the issue to be relevant to them, then for some interviewees, the topic of climate change appeared to be purely an intellectual subject. It seemed the issue of climate change was detached from their reality. This incoherence was intriguing and revealing from an educational perspective. It will be further discussed in next chapter.

It was common for respondents to express multiple negative emotions in their responses in

writing task. An example of this was shown in the following translated response from an anonymous survey respondent in group G3:

"I feel *unsettled* and *sad* about climate change. Because human need to consume different resources for development, which make ecology to lose the balance. If human wants to keep ecological balance, a lot of money and resources are needed. Human is greedy. People will not give up benefits for ecology, or give up opportunity for their countries to progress. Climate change will affect human. But other creatures will be affected before human. I feel *sad* and *sorrow* for the affected living creatures." (translated from written response, anonymous non-interviewee, G3)

While a few respondents expressed positive emotions towards climate change, such as feeling "good," these instances were relatively infrequent. One such rare exception was a respondent who stated that they felt climate change was "quite good, as it would reveal the occurrence of global warming." The respondent's understanding of the relationship between climate change and global warming was unclear from this self-contradicting response.

In addition to emotions, the responses from the writing task exhibited some consistencies with the interview data. For instance, Interviewee 06's written response echoed their verbal response during the interview, as demonstrated in the following passage:

"[I feel] distressed, helpless yet small burst of optimism. The HK government has not put in active effort into tackling the crisis of climate change which is, to a certain extent, understandable because of the labour cost, time consumption and immature eco-technology in HK. Yet, as an environmental-knowledgeable citizen, it is dispiriting to witness the

worsening situation. Still, I do know the world, i.e. world leaders have taken up a more practical and serious approach to confront the crisis and I hope our amends will be effective and come in time. " (writing task of interviewee 06, G1)

The provided response was consistent with Interviewee 06's moderate score of 3.75 in *constructive hope* and low score in *hope based on denial*.

4.3.2.2 Theme: Feeling powerless or helplessness

As evidenced by the emotional profile presented in table 4.19a and table 4.19b, the emotion of powerlessness was frequently reported among the interviewees. In fact, only two interviewees (interviewee 04, G1 and interviewee 05, G2) rated this emotion as a low score of 2, while the rest assigned a score of at least 3. This observation aligned with the findings from our previous survey analysis, which suggested that the emotion of powerlessness was prevalent among the sample.

Verbal responses from the interviewees provided additional confirmation of such sentiments. While half of the interviewees expressed worry about the climate change situation, six of them mentioned feeling either powerless or helpless about it. For instance, Interviewee 02 (G3) said in interview, "I feel a bit helpless. It is because I feel while we know this [climate change] is affecting us, it seems there is no way to change it".

Instead of feeling powerless, interviewee 09 (G2) described her role as passive. In addition to her problematic view on climate change, Interviewee 09 held a limited perspective on her personal role in addressing climate change. Despite her questionable belief regarding climate change (described later), Interviewee 09 still recognized environmental actions as "good."

"My role is passive. But I can be passive and at the same time do something. …What I mean by passive is… like I said it is not something we can solve through action of one man. Even if we have quite a portion of people in the world act together, we still cannot solve it. But if the action starts from the intention to protect the Earth, then it is still a good thing. No matter we can solve the problem or not, this starting point and intention is still good." (Excerpt from interview scripts, interviewee 09)

4.3.2.3 Theme: climate actions

When asked about their responses to climate change through actions, the interviewees' responses were largely similar. Most of the actions mentioned were typical environmental behaviors, such as energy conservation or water conservation, which were reported by 7 out of 10 interviewees. Walking as a substitute for transportation (3 out of 10) and reducing solid waste, such as using fewer plastic bags (3 out of 10), were also common responses.

Closely linked to the sense of powerlessness and helplessness was the belief that individual actions were insufficient as responses to climate change. When individuals perceive climate change as beyond their personal control, they were more likely to experience feelings of powerlessness or helplessness.

Indeed, the discrepancy between the severity of the issue and the actions taken was a common observation among the interviewees. While different interviewees reported responding to climate change through various actions, most of them (7 out of 10) acknowledged that such actions have limited effects. This sense of inadequacy was exemplified in the following quote from Interviewee 04:

"I feel there is no way out. The situation is like this already. What else can you do to change it?...... I feel even if you live an environmental friendly lifestyle, you still cannot make the climate return to normal overnight, or even reduce the occurrence of these extreme weather. When these extreme situations happen, it will last very long time. It is very difficult to solve this problem." (Translated transcript of interview 04, G1)

It was noted that this feeling of inability to make meaningful response to climate change is closely linked to the sense of powerless we just mentioned above. This idea will be explored in greater details in next chapter.

However, it was noted that very few interviewees mentioned participation in any collective actions beyond the individual level. Responses concerning actions in response to climate change were either described on a personal level, or on governmental or international level between different countries. Collective actions in any form at the community or societal level were largely absent from the interviewees' descriptions. Interestingly, none of the interviewees mentioned involvement in any climate actions advocated by non-governmental organizations (NGOs) or governments as their personal climate actions.

Nevertheless, some interviewees made indirect references to their views on community-level action. Interviewee 08, for instance, mentioned a failed attempt to contribute to collective actions, which will be mentioned later.

The absence of collective actions as a response to climate change was a noteworthy observation. The relationship between collective actions and emotions will be also explored in more detail in the subsequent chapter.

4.3.2.4 Theme: pathways to resolve climate change

During the interviews, the interviewees were asked to predict how the issue of climate change would be handled in the future. The responses were varied. Only two interviewees explicitly mentioned international collaboration, while three mentioned various technological advances that could contribute to addressing the issue. However, the remaining responses given by the interviewees were more abstract. Four of the interviewees suggested that raising public awareness about the issue would help addressing it.

Given the concerns expressed by experts regarding the severity of climate change, it was not surprising that most of the interviewees lacked confidence in the ability of humanity to eventually solve the issue. Four interviewees expressed that climate change was difficult to solve, while two expressed that it was only possible to slow it down but not resolve it in the future. Similarly, two interviewees expressed passive acceptance of the situation of climate change, suggesting that humans would need to learn to coexist with it. Interviewee 08 exemplified this idea in the following response:

"I am not that optimistic that it's going to be solved, but if it does, I hope that the world can continue as this, I means not a great world we are living, we still have wars, we have famine, we have hunger and starvation, shortage of water supply in some places, but generally, we seem to be getting better, we are developing towards some more peaceful time, I would hope that it becomes something like that." (scripts of interviewee 08, G1)

The notion of coexisting with climate change contrasted with the dramatic idea that it would somehow lead to the end of humanity. This was exemplified by the following translated response to a writing task:

"It is not possible to recover, it is only possible to fix. The end of the world is becoming closer."

(Anonymous respondent, writing task)

4.3.2.5 Theme: ideas of climate change denial

Within the group of ten interviewees, some instances of climate change denial can be identified in the responses of a few interviewees. Three examples of such ideas were discussed in the following paragraphs.

One relatively mild instance of climate change denial was observed in the response of Interviewee 10, (G1), who stated that the cause of climate change was subject to "some controversies" regarding whether it is caused by natural or human factors. This instance was relatively minor, as the interviewee appeared to have no difficulty in describing the impacts of climate change.

However, the responses of Interviewee 10 to the writing task revealed weakness in her understanding of climate change. She wrote, "I feel very anxious. I feel like public do not have enough awareness to energy conservation and environmental protection, which cause many climate issues remain very serious. From a wider perspective, I think other events like the problem of microplastic and also Japan's discharging nuclear waste water may [perhaps] affect climate change. I deeply feel I have the responsibility to reduce emission, and I also hope more people too [can get involved]." (Translated from written response of interviewee 10, G1)

The above written response of Interviewee 10 revealed she had confusion about the relationship between different environmental issues. While pollution caused by micro-plastics and nuclear wastewater discharge are important environmental issues, it is difficult to establish a direct

linkage between these issues and climate change. This confusion suggested that respondent may view different environmental issues as somewhat similar to one another. If limited knowledge was the source of such confusion, some forms of climate change education (CCE) could be beneficial in clarifying these relationships.

The second example of climate change denial expressed by interviewees was the perception of climate change as a distant event in the future. This idea was mentioned by interviewees 05 (G2) and interviewee 10 (G1), who described climate change as affecting us "fifty to sixty years" from now. This belief is inconsistent with the current understanding of the urgency of climate change, and is often used to justify delayed actions to address climate change in public policy discussions.

The third example of climate change denial expressed by interviewees was perhaps the most problematic. This was the erroneous belief that climate change is solely a natural phenomenon. Interviewee 09 (group G2) held this view, suggesting that climate change could improve in the future even without human intervention. This idea of climate change denial was also observed in online survey data, as discussed earlier.

Although Interviewee 09 had responded to the writing task, her response was very brief and lacked clarity. Her words were "getting strange, responds to heavy economic activities", which did not provide enough information on how she viewed the issue of climate change.

When interviewee 09 was asked to describe the future of Hong Kong in the face of climate change, her response was surprisingly dismissive. "There will be no changes. Because I heard a saying that this is only a process, like a transitional period. So I think for the future, even if nothing is done, …it may still become better…," she stated.

When asked to elaborate on this idea, she reiterated her belief in the notion that climate change is a natural, cyclical process. "Yes, but I solely based on what I heard about this is something like inter-glacial period. Therefore if we wait sometime, it will become better. This is not national or regional. It is as a whole," she explained.

Interviewee 09 also described the situation of climate change as a "loop" or periodic. When asked to clarify this idea, she asserted that such "loop" may happen in "one or two hundred years". She also asserted that natural influences were responsible for majority or roughly 70% of climate change, whereas human is only responsible for minority or roughly 30% of the problem.

When examined closely, it was noted that this interpretation of climate change was quite problematic and contrary to scientific consensus. While it is real that climate change is heavily influenced by natural causes, scientific consensus suggests that human caused emissions are the major causes of climate change in the recent two hundred years. To suggest that current climate change can be resolved naturally as stated by interviewee 09 may be largely based on misunderstanding or naïve optimism.

4.3.2.6 Theme: actions in response to climate change

When asked about their personal responses to climate change, most interviewees (7 out of 10) reported engaging in actions aimed at reducing energy or water consumption. The next most common actions were related to reducing solid waste (3 out of 10), such as using fewer plastic bags, producing less waste, and recycling. Some of these actions were only indirectly linked to climate change. Other actions mentioned by single interviewees included consuming less meat, reducing consumption behavior, and wearing less clothing in response to warmer weather.

However, when asked about their emotions to these actions, the interviewees only expressed mild feelings. Half of the interviewees (5 out of 10) did not feel strongly about their actions, while the majority (7 out of 10) expressed that their actions were inadequate in addressing climate change.

4.3.2.7 Theme: climate change as "distant" event

Within the group of 10 interviewees, some individuals described climate change as a "distant" event, both in terms of temporal and physical distance. For instance, Interviewee 05 described climate change as having an impact "fifty to sixty years" in the future, while Interviewee 02 (G3) suggested that the effects of climate change were mainly occurring in polar regions or other countries.

However, a third type of distancing was also observed among the interviewees. These involved individuals considering climate change as not personally relevant to them. Evidence of psychological distancing was exemplified by some interviewees discussing climate change only from a macroscopic perspective, rather than acknowledging its personal significance. Example of such distancing was observed in the following description of the climate change situation by interviewee 04, "On the whole although it is very miserable for humanity, but I want to say it is *your own doing*. *You* (humanity) need to bear your own responsibility." (Translated transcript of interview 04, G1)

As previously mentioned, a common feature of the various forms of distancing was the false belief that climate change will not have a personal impact. In contrast, Interviewee 08 was a rare exception among the interviewees, considering climate change to be a highly personal issue. This is evidenced by the interviewee's response to the question about the future impacts

of climate change, which revealed that climate change was directly affecting his birthplace.

"… there is going to be instability regarding the food supply, and I think a number of people may starve, people may strike for the food or supplies, different countries may come to war, my country xxxxxx (masked for anonymity) is already [having] a major risk, like you will be seeing in the coming 5 years, there will have a shortage of water supply, …..In the next 5 years, it's going to get worse already….." (scripts from interviewee 08, G1)

Interviewee 08 was also noted for his exceptionally high emotional scores in the online survey. His case will be further discussed later.

4.3.2.8 Summary of the relationship between hope and descriptions of future of climate change

With our summary about various themes from the interview data, we can attempt to answer sub-question RQ2a, which addresses the relationship between hope and future of climate change.

It was observed that most interviewees with different combinations of hope generally perceive the future of climate change in negative lights. The only exceptions of a few respondents of writing task who give short but unclear answers. Most interviewees stated that they believed the situation of climate change is serious and cannot be resolved successfully in the future. The exception is individual students with mixed hope in climate change (interviewee 09) who believe climate change is natural, and current situation of climate change will resolve itself without human intervention.

Perhaps surprisingly, there were no clear differences observed about how interviewees with different combinations of hope viewed their role to contribute to tackling climate change. Interviewees in our study invariantly described themselves as concerned individuals rather than members of any larger groups.

In terms of time frame of climate change, individual students with high scores in *constructive hope* and *hope based on denial* (G1 and G2) believed climate change will only affect humanity in the decades later. Individual interviewee with mixed hope (interviewee 09) believes there will be no changes of the situation of climate change in near future. Otherwise, interviewees generally believed climate change is getting more serious soon.

In terms of actions in responding to climate change, all interviewees in the study mentioned they practiced various environment friendly behaviours including water and energy conservation, while acknowledging the limitations of these activities. Comparison between responses from interviewees with realistic hope (G1) and low hope (G3) who are also studying geography (03 and 07) showed the former had more diverse list of actions. However, all interviewees also acknowledged their actions were unlikely to make necessary influence on the outcomes of climate change. Nevertheless, the present observation from interview data was far from conclusive. Grouping based on hope did not show clear differences in above analysis.

4.3.3 Perception of climate change and their learning experience

The subsequent section of the analysis pertains to sub-question RQ2b, which is shown below.

Sub-question 2b (RQ2b):

In what ways students with different hope in climate change describe their learning experience in the past?

4.3.3.1 Learning experience

When asked about their initial exposure to climate change, the interviewees largely reported learning about the topic during their junior years in secondary school, with either geography or science classes serving as the primary source of learning experience. Several interviewees mentioned that they first became aware of climate change during their primary school years. In addition to the junior secondary level, four interviewees (02 and 07 from G3, 03 and 04 from G1) reported encountering climate change in the DSE geography curriculum during their senior secondary school years. Beyond these four interviewees, climate change was mainly discussed by Interviewee 06 (G1) and Interviewee 09 (G2) during Liberal Studies classes at the senior secondary level. Table 4.29 provided a summary of the two questions pertaining to the interviewees' learning experiences with climate change.

Table 4.23

Summary of Learning Experience of Interviewees

		When	Most memorable
/	Interviewee01	junior Geography and Science	assembly
G1	Interviewee03	junior LS, Geography	F5 Geography lesson
	Interviewee04	junior Geography and Science	Geography lesson
	Interviewee06	primary school	role playing G20 summit
	Interviewee08	P.5 or P.6 self learning	book in primary 5
	Interviewee10	primary school	Art teacher in primary school
G2	Interviewee05	junior Geography	English lesson story
	Interviewee09	primary, junior Geography, LS	service learning activities on waste reuse and recycling
G3	Interviewee02	F1 LS	F4 Geography lesson
	Interviewee07	junior Geography, LS	DSE Geography lesson

The summary presented in Table 4.23 offers several noteworthy observations. Firstly, it was worth noting that interviewees with a geography background were represented in both G1 ("realistic hope") and G3 ("low hope") groups. Additionally, a wide range of learning activities

were considered memorable by interviewees, including sharing in school assemblies, film screenings, and other classroom activities.

Another intriguing observation related to the iconic imagery of polar bears and melting icebergs in polar regions, which were mentioned by two interviewees in G2 when describing their memorable experiences. The significance of this observation will be discussed in later section.

In order to have a more in-depth examination of the influence of past learning experience, we examined the cases presented by different interviewees as shown in the following sessions.

4.3.3.2   Cases of probable climate change denial

As noted previously, interviewee 09 (G2) had the problematic idea that climate change is periodic and can resolve by itself. When queried about the origin of her belief in the problematic "loop" idea about climate change, Interviewee 09 attributed it to her friend studying in another university.

> "My friend studies in other university. He studied a general education course on climate change. But then he never attended the course because he was busy…. At the end of the semester he had to write an essay, he just wrote some clichés about how climate change caused by human activities. He ended up getting a "fail" grade. When he asked the professor why, the professor told him the course was not about these. The professor then also explained the idea of periodic and transitions (in climate) to him. So my friend finally understood." (Translated transcripts, interviewee 09, G2)

Upon hearing this story from her friend, Interviewee 09 sought confirmation from her other

acquaintances regarding the idea that climate change is driven by natural and cyclical processes. While it remained unclear where these friends initially acquired these ideas about climate change, it was possible that they reinforced this doubtful concept through such exchanges among themselves. In additional to her friends, she also claimed she have gained information about climate change came from social media.

As noted previously, Interviewee 09 only had a moderate average score (2.75) for *hope based on denial of climate change* in the survey. However, she agreed quite clearly with two statements (Hb and Hd) on the *hope based on denial* subscale, giving them both a score of 4, while giving scores of 2 and 1 to the remaining two items, Hh and Hl, respectively. These high scores on certain items indicated that she did not view climate change as a significant problem. She also believed that climate change is a natural phenomenon.

From educational perspective, Interviewee 09's account was both alarming and intriguing for a variety of reasons. Firstly, her source of information on climate change was highly questionable. Given her friend's limited participation in university course on the subject, it was unclear how much knowledge he had acquired from his brief exchange with the university professor. Therefore, his interpretation of climate change knowledge cannot be treated as reliable. Similarly, interviewee 09's interpretation of the idea that climate change may follow periodic or cyclic pattern was based on indirect sources and lacked grounding in more reliable sources. Therefore, her interpretation can only be considered as misconception.

However, it is important to note that her descriptions of personal climate actions and her attitudes toward such actions were still rather positive, which echoed her moderate score for the *constructive hope* scale (3.75). As evident from the above excerpts, Interviewee 09

actually had different sources of hope and displayed evidence of both *constructive hope* and *hope based on denial of climate change*. Therefore, she was classified as belonging to G2, as she had "mixed hope" regarding climate change.

Lastly, it is worth noting that Interviewee 09 claimed that she had not learned about climate change from any university-level courses. Given the above evidence showing how she acquired her controversial ideas about climate change from non-academic sources, it is probable that properly arranged learning experience in university could help her establishing a better knowledge basis about climate change.

4.3.3.3 Case of emotionally invested self-learner

Interviewee 08 (G1) was another inspiring case study regarding the role of climate change education. He scored high in the *constructive hope* scale (4.0) and had a zero score in *hope based on denial*. As indicated in the following excerpt, his case was noteworthy because he reported learning about climate change through self-motivated learning.

One striking observation regarding Interviewee 08 was his emotions towards climate change. Survey responses indicated that he shows a wide range of negative emotions such as *powerlessness, overwhelming, pessimism, discouragement,* and *upset*. These emotions were likely to negatively impact his actions. He also reported high scores for various other emotions listed in survey. In fact, he scored at least 4 out of 5 in 15 out of 21 emotions.

When asked about how he feels about the world facing climate change, Interviewee 08 did not directly express his feelings. Instead, he offered the following comment on the situation:

"I personally feel it's an urgent and immediate issue and it is not receiving enough attention and the impact of climate change is going to be widespread, going to affect everyone, especially us, as a coastal city and island city, and that's going to affect the world a great deal."

When probed again about his feeling, he elaborated with the following comments: "To some extent, I feel *worried* but it still seems...I understand it's very urgent but it still seems distant because I can't see the immediate effects very much… I am *concerned* about the humanitarian impacts, really bad situation in many of the developing countries, and we are not ready to deal with the impacts of what will happen, how many people are going to be displaced, concerning the dire effects that is all…. It's like watching a fire get out of control, but I don't know what to do, it's too big, it's a big issue…..sometimes I feel like it's a bad joke like we have seen the movies all the time that they have a global emergency and people finally realize and everyone really acts together because this is affecting everyone. But in reality, we don't care, it is affecting everyone but not enough of everyone. The rich people, the rich countries will be fine, it's the poor who suffer, and nobody cares about the poor people."

Despite being emotionally invested in climate change, Interviewee 08 appeared uncertain about how to respond. Although he described personal actions he could take, he expressed a desire to contribute to addressing the problem beyond the personal level. However, he felt confused and believed that not enough had been done at the national level.

> "Like I said, this is about that *confuse* me, I don't know that how I can affect this by myself. On my own, sometimes if I have the choice, I would not use plastics, I would not use paper that much, I would try to save electricity, but that's my own personal habits, I don't know how I can impact because this is a huge issue, a lot of the pollution

is going from the cities because of the traffic transportation, because of the [power] plants, because of industrial manufacturing, and these things *are very far out my control*." (excerpts from interview, interviewee 08, emphasis added)

Regarding his role in addressing climate change, Interviewee 08 regarded himself as a concerned individual. However, he expressed disappointment over the lack of collective actions from others in society. The following excerpts illustrated this sentiment:

Interviewee 08: "I would consider it as an individual, I don't think there is a collective effort from anyone, the government has the target of 2030, some governments have the target of 2050, there is a carbon credit which rich countries can buy and the poor countries sell, a lot of countries don't meet their own requirements for the goals for the climate change, for preventing climate change. Lots of countries have goals which are not realistic which don't meet the scientific projection, the academic projection of what is necessary to avoid or you know, to slow down the actual impact."

Interviewer: So you talk about this, let's say carbon credit, what is your relationship with this kind of concept?

Interviewee 08: This is really far out of my control, I think an individual can't do much about it.

Interviewer: So you say you know these, but you have no connection or you have no responsibility with this kind of concept?

Interviewee 08: I definitely have a connection, and as one of the human beings, I have the responsibility though. Collectively, this is our fault, our responsibility. Alone, I don't think I can do much, something that is not significant.

(excerpts from interviewee scripts, interviewee 08)

Interviewee 08 also shared a potentially inspiring story about a role model when he recalled one of his teachers from his secondary school years. Among his various learning experiences, he encountered a teacher who he perceived to be passionate about environmental issues. He described this teacher as being more optimistic about environmental issues than himself. According to Interviewee 08, the same teacher had also organized activities related to solid waste reduction.

"…my teacher, my former teacher is more optimistic, she wanted to have a food-related start-up to avoid, to reduce food waste. But eventually, [when we were] researching the solutions seeing how there are (sic) different applications across the world, we found that it's not realistic. I mean in Hong Kong, we have less than other places, that's for sure, but we can cut it down to zero as well, we have the potential as a city. But because of government regulations, because of public concerns, some of which are unwarranted, unreasonable, [we] can't do anything about that. We are...like I said, we are in a bad situation, we are making it worse, and if somebody does try to do something, you are making it harder for them. You can think of this situation, in my sense would be like a fire, it is a fire now in a building, we guys are putting petrol on it, and if somebody tries to put it out, we are hitting them." (Transcript of interview 08)

This episode of learning experience was not a very positive one and it seemed to contribute to a sense of frustration when trying to contribute more to solving societal problem. The experience was however quite consistent with the overall pessimistic attitude of interviewee 08 toward other climate actions.

Interviewee 08 reported that he primarily learned about climate change through self-education, which included reading books on the topic during his primary school years. While he indicated that he had not learned about climate change from any university courses, he had attended courses on environmental issues, including waste recycling. Based on his responses regarding the impacts of climate change, he appeared to be quite knowledgeable about the subject. However, it was debatable whether his pessimistic attitude towards collective action in tackling climate change was well-founded or not.

It was also uncertain how additional learning experiences in climate change education could alter his perspective. When asked if he wanted to learn more about climate change through university education, he gave the following negative response:

"I don't think I want to learn anymore. I know a lots already, and I don't see anything significant and being done about that by anyone in charge. *You learn more about it and that's more depressing.*"

In summary, Interviewee 08's case was remarkable compared to other interviewees who had more limited learning experiences about climate change. He demonstrated substantial self-learning on climate change and other environmental issues and maintained pro-environmental behaviors, some of which were directly related to climate change. However, he did not express significant emotional attachment to these actions, considering them as mere habits.

Despite his knowledge and behaviors, Interviewee 08 held a negative outlook regarding responses of humanity to climate change. His genuine emotions of worry and confusion regarding the issue may be linked to his prior experience of self-learning. Although he had

attended courses on wider environmental issues, he had not taken any courses specifically focused on climate change before or after entering university. Moreover, his pessimistic outlook about climate change may also be partially attributed to his personality, a linkage that was suggested by himself.

In the following chapter, we will discuss the potential features of climate change education at the university level can contribute to a more positive learning experience for students like Interviewee 08.

4.3.3.4 Case of two Geography students

The next few paragraphs presented and analyzed the similarities and differences in the responses of Interviewees 03 and 07, both of whom were geography major students. As climate change is a crucial topic in geography, both interviewees reported learning about it through university-level courses. Specifically, they both studied a mandatory course, "Climate change and Global warming" as part of their undergraduate geography as their major study area. However, Interviewee 03 also registered as Liberal Studies as his minor of study, whereas Interviewee 07 did not indicate any minor study area.

The two interviewees shared similar educational backgrounds, having studied geography in secondary school. They first learned about climate change in Form three, and both provided detailed responses to questions about the impacts of climate change, both locally and globally.

Despite their similar educational backgrounds, the two interviewees showed subtle differences in their emotions to climate change. When asked about their feelings regarding the impacts of climate change, Interviewee 03 expressed a mix of emotions, including worry and apathy. He

also expressed uncertainty about other people's attitudes towards the issue, stating that although many people care about it, many do not take action to improve the environment. Interviewee 03 said, "I feel I don't know what to deal with it."

Interviewee 07 also had similar emotions, feeling somewhat powerless regarding the impacts of climate change. However, he believed that giving up was not an option, and everyone needed to learn about and contribute to solving the problem. He said, "That is to say everyone still has to face it and learn it, and everyone also needs to contribute to [solving] it."

The emotional profiles of Interviewees 03 and 07 were shown in Figure 8. It is worth noting that they belonged to different groups determined by types of hope, with Interviewee 03 belonging to G1 and Interviewee 07 belonging to G3.

Figure 8

Emotional Profile of Interviewee 03 (G1) and Interviewee 07 (G3)
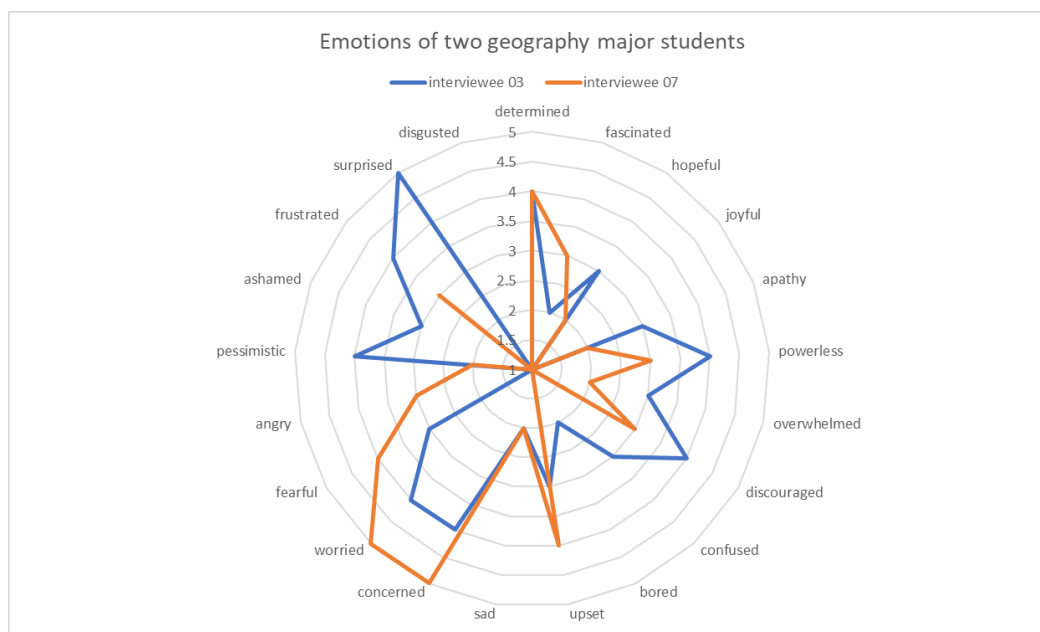
It can also be observed in Table 4.19c that Interviewee 03 exhibited stronger emotions in two categories (E2 and E4) than Interviewee 07, who only showed a stronger emotion in category E3. Based on our previous discussion about the relationship between emotions and actions, a higher mean score in E3 suggested a greater inclination towards climate action, while a higher mean score in E2 indicated a greater inclination towards inaction. Therefore, we would expect Interviewee 07 to be more inclined to act upon his concerns about climate change. However, upon examining their responses, the patterns were not so clear. While both interviewees mentioned various environmentally friendly behaviors, Interviewee 03 provided a more diverse list of actions, including water and energy conservation and less dependency on transportation, while Interviewee 07 repeatedly mentioned reducing plastic waste by buying less bottled water. It is worth noting that plastic waste is only indirectly related to climate change, which raises questions about why it was mentioned as one of the most important personal climate actions by Interviewee 07. Apart from this behavior, there were no clear observable differences between the responses of Interviewee 03 and Interviewee 07 that could be explained by differences in emotions.

While Interviewees 03 and 07 had similar learning experiences, Interviewee 03 had more diverse learning experiences related to climate change. He participated in a summer day camp event hosted by a local university about marine conservation, during which he conducted surveys and experiments to explore the effects of global warming on marine ecological systems. In contrast, Interviewee 07 did not mention any similar learning experiences.

Compared to other interviewees, these two geography majors were well-informed and educated about the knowledge base of climate change. However, Interviewee 03 reported a strong emotion of powerlessness towards the future of climate change. Both Interviewees 03 and 07

also expressed a sense of powerlessness in their verbal responses to the future of climate change. If such sentiments of powerlessness are common among students who already have considerable learning experiences in climate change, it may indicate that adjustments in the curriculum of climate change education should be explored. This idea will be discussed further in next chapter.

4.3.3.5   Case: climate change considered as "distant" event

Interviewee 05, a fourth-year female creative arts student hailing from mainland China, expressed that she had not formally studied climate change in university courses.   She demonstrated the highest scores for *hope based on denial* of climate change among all the ten interviewees. Additionally, her responses to survey questions indicated an agreement with several ideas of climate denial, including two out of four statements in the *hope based on denial* of climate change scale. She strongly agreed (5 out of 6 on the Likert's scale) with the statement (Hd) ("Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create."), agreed (4 out of 6) with (Hl) "Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change." and also somewhat ambiguous (3 out of 6) with (Hh) "Because I doubt that there is any change in the climate.".

However, despite demonstrating a high degree of *hope based on denial* of climate change, it was difficult to categorize interviewee 05 as a climate change denier based on her responses to the writing task and interview questions. Her case was multi-faceted, and she exhibited a nuanced understanding of the issue.

In the writing task, Interviewee 05 acknowledged that climate change was occurring and

expressed concern about its effects. Specifically, she stated, "I am concerned and really impatient to do something to slow the rate of climate change. In the past, climate change had little impact on me. But now I gradually feel the intensification of climate change, the impact on life is becoming more and more obvious."

During the interview, Interviewee 05 revealed that she had learned about climate change in geography class in lower secondary school, which was her primary source of knowledge on the topic. When asked about her thoughts on the future of the world facing climate change, Interviewee 05 expressed anxiety and a feeling of helplessness. She stated, "I feel anxious when I think about it. But I feel my actions daily do not seem to help much."

Although Interviewee 05 regarded climate change as a distant issue, she was able to describe various impacts of climate change in the polar and coastal regions. However, her comprehension of the time frame of climate change was questionable, as she suggested that the effects of climate change would only occur in a few decades or centuries. Additionally, while Interviewee 05 acknowledged that climate change was causing the loss of habitats for animals in the Arctic and Antarctic regions, she also expressed the belief that the current effects of climate change were not significant, despite feeling that summers were hotter than before.

Aside from Interviewee 05's endorsement of climate change denial ideas, her descriptions of climate change as a distant event both in temporal and spatial senses is noteworthy. Although it is common to visualize the impacts of climate change in polar regions, impacts of climate change were already quite noticeable at the time of the interview. Therefore, climate change can no longer be regarded as an issue in the distant future. However, when asked about when climate change will affect us, Interviewee 05 again replied that it would affect us "maybe fifty

to sixty years in the future." Essentially, she suggested that the problem of climate change is a problem for the next generation.

Regarding her role in tackling climate change, Interviewee 05 considered herself an individual. Her response also revealed her thoughts on the idea of her limited personal influence: "My role is an individual person. It is because I think it should be the responsibility of the government to rally other people to do something. For me, I can only do my own things." Notably, there were no attempts or intentions from her to exert personal influence on other people as an educator in tackling climate change.

Interviewee 05 listed some typical environmentally friendly actions, including using mass transportation, using fewer plastic bags, and setting the air-conditioner temperature to 26 degrees Celsius. However, she also expressed doubts about the limited influence of her personal climate actions, stating, "Even when you are doing all these actions daily, suddenly in the news, you see that the climate has become very bad. Then I will feel very strange and confused. My actions do not have much help to climate change."

Despite some problems in her attitudes about climate change, Interviewee 05 did provide an inspiring episode of climate change education from her previous learning experience. She recalled her most memorable learning experience from her English lesson in her first year of secondary school, in which the story was told from the point of view of a polar bear. She remembered feeling pity for the bear and being shocked by the melting of the Arctic ice cap. It is noteworthy that she could still recall this learning experience in such details many years later, and her emotions were still attached to this episode of learning experience.

In summary, while Interviewee 05 had aligned herself with certain ideas about climate change denial, it is likely that she was not properly informed about the facts of climate change from her previous learning experiences. She had limited learning experience about climate change from nearly ten years ago, and as a result, she described climate change as events happening far away and sometimes in the future.

It is possible that a well-designed learning experience in an undergraduate program at the university level could facilitate her in developing more accurate ideas about climate change. The characteristics of such learning experiences and the significance of this case will be further discussed in the next chapter.

4.3.4 Summarizing the impacts of hope in climate change on their perception of learning experience

Based on the previous cases of interview data, attempt was then made to answer sub-question RQ2b, which was about how students with different hope described their previous learning experience.

Sub-question 2b (RQ2b):

In what ways students with different hope in climate change describe their learning experience in the past?

While the data obtained from the interviews was limited in scope, notable patterns had emerged regarding hope in climate change and past learning experiences. Such similarities were described in the following three paragraphs.

The first similarity in learning experiences was observed among students with mixed hope. It was observed that the two interviewees with mixed hope (interviewees 05 and 09, G2) associated climate change with distant imagery of polar regions that they had seen in the past. This may partly explain why they have difficulties to identify climate change as an imminent problem that was related to themselves.

The second similarity in learning experience was observed among interviewees with low hope (G3) in the future of climate change. When the two interviewees with low hope (interviewees 02 and 07, both in G3) described their past learning experiences about climate change, both indicated feeling powerless at times during the learning process. Interviewee 02 expressed a strong feeling of powerlessness in his survey response and described himself as unable to do much about the situation of climate change. Interviewee 07 also explicitly mentioned feeling powerless while learning about climate change, even though this was not the only feeling mentioned in his learning experience.

However, it is important to note that the feeling of powerlessness was very common among interviewees. Given that the feeling of powerlessness or helplessness was also mentioned by half of the interviewees with different types of hope, it is premature to link the feeling of powerlessness to students' low hope in climate change.

When the two geography major interviewees (Interviewees 03 and 07, G1 and G3 respectively) with similar learning backgrounds were analyzed, it was found that Interviewee 03, who had higher *constructive hope* in climate change, also mentioned more diversified extra-curricular learning experiences. He recalled different learning experiences, including laboratory works and surveys from the past. Although the data was still limited in this case, such differences in

diversity of learning experiences may be relevant for explaining the differences in hope toward climate change.

4.3.5 Answering Research Questions RQ2

With the above analysis and discussion with the qualitative data from interview, we can now return to addressing research question 2.

> Research question 2 (RQ2): How do students' hope in climate change affect their perceptions of the future of climate change and their learning experience in the past?

Based on our previous analysis of survey and interview data, we can summarize our findings on the relationship between hope about the future of climate change and past learning experiences. Our analysis from RQ1c confirmed that, as a whole, our sample had stronger *constructive hope* than *hope based on denial*. While the curriculum remained the primary source of learning experiences about climate change, students' perceptions of their past learning experiences may vary.

Although this present study cannot confirm how previous learning affects students' hope in climate change with limited data, our findings suggested that students' perceptions of their past learning experiences exhibited significant differences among students with different hope in climate change. As revealed by RQ1e, higher hope in climate change, as determined by the hope scale used in this study, was linked to a more positive perception of past teachers' attitudes in communication. Among the same samples, those with higher *hope based on denial* (in group G2) were likely to feel that teachers in their secondary schools focused on the hopelessness of societal and environmental issues. However, this correlation between hope and past learning experience did not imply causation, as interview data from the current study had not provided

evidence to confirm of such a linkage.

Our analysis for sub-question RQ2a indicates there was no apparent clear relation between hope and how students described the future of climate change. Subsequent analysis for sub-question RQ2b indicated that interviewees with mixed hope in climate change (interviewee 05 and 09, group G2) often associated climate change with iconic imagery of environmental impacts of climate change in polar regions that appeared in learning materials and mass media from their memory. This may help to explain why they were inclined to perceive climate change as an event happening at distant times and locations. Similarly, when comparing students who were studying geography as their major subject in university, it appeared that the interviewed student with more diverse learning experiences in climate change also had higher *constructive hope* in climate change when compared with students who had more limited learning experiences outside classroom learning. Coincidentally, most of the students with higher *constructive hope* but low *hope based on denial* (G1) can recall some memorable learning experiences about climate change outside of the classroom. As a contrast, it was observed that individual interviewee with mixed hope (G2) (Interviewee 09) acquired climate change denial ideas mainly from non-academic sources including peer and social media. Such case reminded us of the potential influence from such sources peers and social media can be quite powerful.

4.4 Lesson observation

As noted in the previous chapter, the researcher had obtained two lessons with thematic focus on climate change. These were analyzed in the following section to address the third research question.

Research Question 3 (RQ3):   In what ways are emotions and hope in climate change education being handled by teachers in exemplar lessons in Education University of Hong Kong?

I started this section with the descriptions of these two lessons, followed by the analysis for each lesson.

4.4.1 Descriptions of the lessons

Lesson A was a pre-recorded lecture delivered in early 2020 and titled "Climate Apocalypse". This lecture was one of ten lessons in the General Education Foundation Course (GEFC), which was mandatory for all undergraduate year one students. For each lesson, students were required to attend a mass lecture or watch a video-recorded lecture at the beginning of the week. They were then required to attend tutorial sessions later in the same week, during which tutors guided students in discussing the content of the lecture. The speakers also provided a few questions for tutorial discussions.

The researcher also served as a tutor in both 2019 and 2020. The same lecture, Lesson A, was included in the GEFC for both years. Based on this timeframe, all students in year two or three at the time of data collection for the current research should have attended this lesson in previous years of study. The content of Lesson A could be considered one of the most widely participated learning experiences in climate change education in the current university curriculum. Therefore, it was selected as one of the exemplar lessons to be analyzed.

The second lesson, Lesson B was one of the lessons in the semester-long course titled "Climate Change and Global Warming" in the autumn semester of 2020. The course was mandatory for BEd programme for geography major students in their second year of study.

The contents of the course loosely followed the works of three working groups of the IPCC. According to the course outline, the course contents covered much of the basic knowledge of climate change. The list of topics on the course outline included the basis of global climate, weather, climatic variability and climate change, the science of global warming, monitoring and mitigation, and imperatives for adaptive responses. In terms of assessment, students were assessed with an individual presentation, an essay, and an examination.

With the permission from the teacher of lesson B, the researcher had gained access to the teaching materials used in nine lessons out of the total of 12 lessons in the course. The teaching material was first scanned preliminarily before one lesson was selected for further analysis as exemplar Lesson B. The lesson selected for the following analysis was based on its probable relevancy to emotions and hope of the students. At this point, it was noted that the linkages between the listed topics of the lessons and personal climate actions were not obvious. It was not surprising, as the course mainly approached the issue of global warming and climate change from historical, scientific, and other more macroscopic perspectives, involving economic and political collaboration at the macroscopic and international level. With these macroscopic perspectives, it was not directly apparent how the influence of individuals would be handled in the lessons.

The lesson selected as Lesson B for further analysis was the eighth lesson in this course, titled "Energy Policy". The lesson was selected based on this topic having potential linkages to the daily life actions of ordinary citizens. The intention here was to use this lesson as an indication of how teaching and learning can link with our research interest in hope and emotions of climate change.

A summary of the background information for the two lessons, A and B, was presented in Table 4.24 below. It was readily apparent from this information that the two lessons had quite distinct target groups in mind. Therefore, we can expect the delivery process of the lessons to have quite different emphases.

Table 4.24

Background Information of Two Exemplar Lessons Being Analyzed

	Lesson A	Lesson B
Target student	All Year 1 undergraduate students	Year 2 or Year 3 BEd Geography major students
Course Name	General Education Foundation Course	Climate Change and Global Warming
Title of the lesson	Climate Apocalypse	Energy Policy
Duration of the lesson	106 minutes	139.5 minutes
Format of the lesson	Pre-recorded lecture	Recorded online synchronous lesson

4.4.2 Analysis of Lesson A

The lesson analyzed consisted of 54 slides and lasted for 106 minutes. Most of the slides (42) were devoted to the discussion of climate change from a global perspective. Five slides focused on the impacts of climate change specifically on Hong Kong, and another eight slides discussed what Hong Kong can do in response, including three slides devoted to the discussion of options for electricity generation.

The codes generated from analyzing the contents of the lesson were summarized in the table 4.25. The unit of analysis was the content of each segment of speech between slide transitions. As there can be multiple codes assigned to each segment of speech, there were more codes than the number of slides.

The coding scheme in Table 3.4 of Chapter 3 were used for the interpretation of the codes.

Table 4.25

Coding of Lesson A

Code	Sub-group		Count
	Teaching contents		
G2		Climate change as event in near future	1
G3		Abstract descriptions of impacts of climate change	6
G4		Concrete descriptions of impacts of climate change in global level	22
G5		Concrete descriptions of impacts of climate change in local level	6
G6		Concrete descriptions of impacts of climate change in specific places in the world	1
P1		Examples of international collaboration	7
P2		Examples of scientific/technological solution	4
P3		Examples change of practice in society	2
P4		Example of change of awareness of cultural or society	1
A1		Personal actions related to climate change	1
R1		As individual/citizen	1
	Teaching process		
Q2		Teacher asks students to express their views about societal and environmental issues	1
F6		Teacher indicates he is aware of the emotional implications of the climate change messages.	2
T1		Teacher talks about societal and environmental problems in the classroom while indicates possible ways to solve those problems in the future.	1
	Others		
O1*		Ethical dimension of climate change	4
		Total codes:	63

4.4.2.1 Observation from Lesson A

Drawing from the coding presented in the table 4.25 above, we can deduce certain conclusions about Lesson A. These are summarized in the following paragraphs.

4.4.2.2 Teaching content

The notes presented above indicated that Lesson A primarily focused on the different impacts of climate change. The highest frequency of notes was assigned to global impacts of climate change (G4). Additionally, the lesson contained descriptions of climate change impacts in the local context (G5). Some of the descriptions pertaining to the impacts of climate change were more abstract in nature and included discussions on the ethical aspects and injustices of the climate change situation. Examples of such issues included the greater severity of heat wave impacts on poorer people or countries.

4.4.2.3 Pathways for resolving climate change

Regarding pathways for addressing climate change, Lesson A mentioned international collaboration (P1) the most, with half of the notes assigned to this code. This was mainly discussed in the context of the situation of climate change before and after the Paris Agreement. Scientific/technological pathways (P2) were also mentioned, primarily in relation to options for electricity generation. The other two pathways, namely via the change of practices and via the change of awareness of cultural society (P3 and P4), were briefly mentioned but not elaborated on extensively.

4.4.2.4 Actions and roles in climate change

In Lesson A, the speaker mentioned multiple personal actions that were commonly associated with climate change, such as eating less meat, waste recycling, and reducing air travel.

However, the discussion of collective actions was primarily restricted to policy options for energy generation. There was no discussion of any other form of collective actions at the societal level to address climate change. Additionally, there were no explicit descriptions of different roles or identities in tackling climate change mentioned in the lecture, other than citizens or youth.

4.4.2.5 The teaching process

As Lesson A was in the form of a recorded lecture, it is not surprising that the speaker made no explicit attempts at questioning. Moreover, the lecture was not interactive, as the speaker did not provide thinking questions during the lecture or use any mechanism to solicit responses from the audience.

Concerning the emotional aspects related to facing climate change, the speaker made relatively few explicit attempts to address these feelings and emotions. However, the speaker did elaborate on why he chose the title of "climate apocalypse," even though he was hesitant about the negative impact on how the audience perceived the future of climate change. This instance was marked with a code of F6 in the notes, which was the only explicit code marked under the feelings and emotions category for this lesson.

Regarding agency thinking, there were no clear indications that the speaker conveyed such messages in this lecture. Hence, there were no codes marked in this category (AT1 to AT4). However, towards the end of the lecture, the speaker did metaphorically ask the audience to join hands in "writing the scripts" for the future of climate change. Such a metaphor can be considered as the speaker hinting that youth could contribute towards alleviating climate change (AT2).

Considering the idea of pathway thinking in the teaching process of Lesson A, it was evident that the speaker had indicated possible ways to tackle climate change. Although the speaker mentioned that there is no silver bullet solution to climate change, he did indicate various actions that can contribute to the cause. Hence, the code T1 was marked to indicate this inclusion of pathway thinking.

Through the current analysis of Lesson A, it was discovered that there were no existing codes that dealt with the ethical considerations when responding to climate change. As such considerations may also have implications for the emotions in learners, a new category of codes (others) was introduced, with the code O1 marking *ethical dimensions* of climate change being mentioned in the lesson.

4.4.3 Analysis of Lesson B

Lesson B was an online recorded lesson that lasted for 139.5 minutes. The lesson was conducted in the first semester of the 2020/21 academic year via synchronous mode on the Zoom platform. The teaching materials for the lesson consisted of 34 slides. The results of the preliminary coding process are shown in the following table 4.26. Similar to Lesson A, the unit of analysis adopted for lesson B was the segment of the teacher's talk between slide transitions.

Table 4.26

Coding of Lesson B

Code		Meaning of code	Count
	Teaching content		
G3		Abstract descriptions of impacts of climate change	1
P2		Examples of scientific/technological solution	4
P3		Examples change of practice in society	4
R3		As future teacher/educator	2
	Teaching process		
AT1		Teacher describes his/her personal engagement to tackle climate change.	1
Nil		Slides with no codes assigned	10
Others		Discussion of energy policy	13
		Total	35

4.4.3.1 Observation of Lesson B

When compared with the codes for previous lesson, Lesson B presented a markedly different picture in the analysis. Since the lesson was primarily focused on energy policy from international perspectives, there were relatively few instances where the teacher explicitly addressed emotional aspects in the teaching process. It was evident from the coding process that a significant number of slides had either no codes assigned or no suitable codes from the existing coding schemes. The latter ones were marked with "others" in the above table. These observations suggested that the linkage between these parts of the lesson to the emotions and hope of the students was not so explicit.

4.4.3.2 Teaching content

Regarding the content of the lesson as presented on the PowerPoint slides, the majority of the material focused on the various factors that need to be considered when making energy policy. These encompassed the diversified sources of greenhouse gases (GHGs), the current global situation surrounding GHG emissions, and the different options for generating energy across the world. Given that energy use is closely linked to various economic activities, the strategies mentioned for limiting GHG emissions were also influenced by the economic development status of different countries. The teacher also highlighted several important factors for consideration, such as developing new or alternative energy sources and the importance of energy efficiency. Moreover, it was noted that energy policy impacts different stakeholders at various levels, including within society and at each country level, as well as between different countries at the international level.

The final one third of the lesson was dedicated to discussing how to assess the costs and benefits of energy policy. The teacher used a single case to demonstrate how to assess energy policy during an in-class reading activity. The session ended with the teacher summarizing the main ideas from the lesson.

While the above content was crucial in deepening students' knowledge about the policy aspects of addressing climate change, it was not immediately apparent from the analysis how the lesson contributed to students' hope and emotions regarding climate change. This was reflected in the relatively few codes in the corresponding categories, as indicated above.

4.4.3.3 Pathways for resolving climate change

Although the entire course followed the work of international collaboration under the

framework of the Intergovernmental Panel on Climate Change (IPCC), the primary focus of Lesson B was on the complexity and diversity of the issues faced by different countries in formulating their energy policies. As indicated by the codes P2 and P3 in the above table, the pathways for addressing climate change discussed in the lesson centered on adjusting various options for energy generation and improving energy efficiency. Both approaches can be considered scientific or technological solutions to tackle climate change (P2). Additionally, the discussion of energy efficiency can be extended to changing some existing practices in our society (P3).

4.4.3.4 Actions and roles in climate change

In Lesson B, the teacher made several comments emphasizing the importance for students to acquire knowledge and critical thinking skills for their future roles as teachers. These comments were represented as code R3 in the table. However, there were no other different roles or identities explicitly mentioned throughout the lesson when discussing various issues related to climate change. The implications of this observation will be discussed later.

Surprisingly, there were very few examples of climate actions mentioned in this lesson. The rare exception was the energy efficiency labeling scheme in Hong Kong, which was briefly mentioned as an example of local energy policy. However, possibly due to the limited time available for the lesson, the teacher did not elaborate much on the scheme's significance and how it can be related to actions in our daily lives. Furthermore, no questions or discussions were initiated to explore students' views on this issue during the lesson.

4.4.3.5 The teaching process

In Lesson B, the teacher primarily responded to students' inquiries by pausing to answer their

written questions whenever they arose via the chat room feature of the online lesson platform. The teacher also asked students if they had any questions about the lesson's content. However, the teacher did not explicitly address the emotional aspects and hope of the students regarding climate change during the lesson. There were no explicit questions asked about how the students felt about the situation of climate change they were learning. Moreover, as the teacher discussed GHG emissions and energy policy, there was no evidence to indicate whether he was optimistic or pessimistic when describing the future of climate change. It was not immediately apparent whether the teacher was aware of the emotional implications of the climate change messages, which was why there are no codes about feelings and emotions in the table of codes above.

Regarding the idea of agency thinking, there was limited evidence of its presence in the teaching process of Lesson B. The teacher did not explicitly state how students can make changes based on the information and knowledge presented in the lesson. However, the teacher did draw a connection between what he was teaching about catering to individual needs in energy policy and his personal experience with air-conditioning. Nonetheless, there were no apparent connections made between the knowledge introduced and personal capacity to change in the lesson. This is why there is only a single code from the category of agency thinking (AT1) in the table.

Concerning pathway thinking, it was again observed that the teacher took a relatively neutral stance in this lesson. As energy policy was the focus of the lesson, emphasis was placed on how multiple factors should be considered in formulating various energy policies. The teacher did not explicitly elaborate on his own thoughts on whether specific pathways to tackle climate change were likely to succeed or not. Additionally, the teacher did not ask students to explore

or reflect on their views regarding the feasibility of these pathways.

4.4.3.6 Overall observation of Lesson B

The above analysis and observations indicated that the teacher in Lesson B focused on enriching learners' knowledge of energy policy and placed considerable emphasis on critical thinking, as evidenced by the teacher's handling of students' questions. However, the emotional aspects of climate change education were not given much attention in the lesson. Instead, the lesson focused on factual knowledge and critical thinking. The analysis showed that there were few clear linkages made to the emotional aspects of the learners, as the analysis framework adopted here highlighted emotional elements that were previously not given much attention. While this omission may not necessarily be problematic from a pedagogical perspective, the observations and analysis suggest that there may be missed opportunities for the teacher to address the emotional aspects of climate change education, which will be explored further in the next chapter as we discuss opportunities for curriculum enhancement.

While similar analysis could be conducted for the other lessons of the same course for comparison, it was not done here as Lesson B was used as an exemplar.

Combining the data from the lesson observations with what the interviewees mentioned regarding their previous learning in climate change education, a few consistent observations emerge from both sources of data. Firstly, the pathways for resolving climate change were considered to be quite restricted in both cases, with relatively little emphasis placed on community-level interventions. Climate actions remain either implemented at the personal level or international level. Coincidentally, efforts by different organizations at the community level other than governmental efforts were not given much coverage in both observed lessons.

Secondly, in both interviews and the two observed lessons, there were few explicit attempts to connect students' roles in climate action outside of personal actions. Both issues are relevant when attempting to answer the research questions in the following section.

4.4.4 Reviewing how teachers handle emotions and hope in exemplar lesson of Climate change education

Research Question 3 (RQ3):   In what ways are emotions and hope in climate change education being handled by teachers in exemplar lessons in Education University of Hong Kong?

Based on the analysis of the two exemplar lessons, it can be concluded that teachers tend to give only peripheral attention to emotions and hope in climate change education. In Lesson A, while the teacher was aware of the possible emotional implications of the severity of climate change, there was little evidence to suggest that the teacher attempts to guide the students to achieve any explicit targets on the emotional aspects by the conclusion of the lesson.

A similar situation was observed in Lesson B. As the focus was on the knowledge aspects of energy policy and critical thinking in analyzing energy policy, there was not much evidence to suggest that the teacher paid much consideration to the emotional aspects of learning during this lesson.

Based on the above analysis, it can be concluded that in both exemplar lessons about climate change, the emotional aspects of learning were not given much attention. If the importance of emotional aspects of climate change education was recognized, evidence-based improvements to CCE will need to be discussed. It will be followed-up in next chapter.

4.5 Summary of findings

In this chapter we had attempted to address the three research questions of this study. We learned that the most common emotions about climate change felt by students were determined, powerless, pessimistic, concerned, worried and fearful. We also learnt that the feeling of powerless increases with the years of study among the surveyed students.

Regarding various hope about the future of climate change, while *constructive hope* was more common than *hope based on denial*, there was evidence that about one third surveyed students had doubt about the causes of climate change. Even when scientific consensus and evidence supports clearly that contemporary climate change is largely caused by emission from human activities, one third of surveyed student had doubt about this consensus.

It was also found that different combinations of hope about climate change were linked with significant differences in some emotions reported by students. Different combinations of hope were also linked to significant differences in their perceived teachers' communication style. The latter was linked to how they perceive past learning about environmental and social issues.

Interview data had also provided us with detailed descriptions of how students described climate change and previous learning experiences. With our current samples of ten interviewees, it was observed that the feeling of powerless and helpless were quite common among students. Regardless of what type of hope was expressed by the students, students responded to climate change mainly through various environmental responsible behaviours, while also acknowledging the limitations of such actions. Some features of past learning experience about climate change were noted from anecdotal account of past learning experience. While deduction about relationship between past learning experience and hope

possessed by the students remains inconclusive based on existing data, further discussion

about possibility of enhancing climate change education can be explored in next chapter.

Chapter 5 Discussion & Conclusion

5.1 Overview of the chapter

This chapter commences with a summary of the principal findings of the study, as determined by the exploration of the three research questions. Subsequently, the implications arising from the key findings are discussed. This discussion is followed by evidence-based recommendations for augmenting the efficacy of climate change education in the university context. Lastly the thesis concludes with the key messages from the study.

5.2 Discussion

This section reviews the key findings of this study while also compares and contrasts with existing literature.

5.2.1 Emotions of students

In the preceding chapter, the findings of section 4.2.2 reveal the prevalent emotions expressed by students regarding climate change. The results indicate that over fifty percent of the surveyed students reported feeling powerless, concerned, pessimistic, determined and worried about climate change.

Compared with recent study such as Wang et al. (2018) and Hickman and the large-scale study by Marks et al. (2021), it is observed students in current study shared concerns and worries about the future of climate change, while at the same time also share the powerless sentiment felt by this generation.   While it is reasonable for students to feel apprehensive about the state

of climate change, the prevalence of powerlessness among youth is counterproductive to any serious attempts to mitigate this global crisis. Furthermore, the prevalence of powerlessness is inconsistent with the objectives of teacher education which should emphasize on nurturing competency of future teachers.

Another intriguing finding from the analysis of survey data is the distribution of powerless emotion. It was found that senior students in their fourth and fifth years of study experienced a greater sense of powerlessness than junior students in their initial two years. Notably, this was also the only emotion that demonstrated a significant *increase* across years of study. Such observation about powerlessness is not found in other existing studies about young people cited in current study. While this distribution alone does not mean growth or progression of this sentiments in individual students, further studies will need to check if such trend persists.

While fear about the state of climate change was also rather common among the participants, it was reported by less than 40% of the surveyed students. This percentage is much lower than average of 67% in other countries (Hickman et al., 2021, p867). These findings may seem somewhat surprising given the pressing and severe nature of the imminent global climate crisis. However, a smaller presence of fear among the surveyed students may also be resultant from different psychological coping strategies by students as described in literature review. The consequence of this difference is currently unknown as the role of fear in motivating climate action is mixed from past research. (Wang et al., 2018; Chu & Yang, 2019; O'Neil and Nicholson, 2009)

In terms of gender, female students expressed stronger feelings of upset and sadness about climate change than their male counterparts. Otherwise, there were no significant differences

between the two genders in the survey data.

However, there were not much evidence suggesting past learning experience in curriculum and current study had made any substantial changes to students' emotions about climate change. When comparing reported emotions across different subjects of study in university, no significant differences were observed. Furthermore, comparisons were made between students who had studied climate change in university courses and students who had not. Although there were minimal significant differences when examining individual emotions, when emotions were grouped according to their positivity, negativity, and potential implications for action, significant differences were observed in the subgroup of positive emotions. The results indicated that among the surveyed students, those who had learned about climate change in university courses experienced only slightly more positive emotions. However, these positive emotions were comparatively weak and therefore not considered very significant. Judging from the available evidence from present study, the effects of academic studies to the students' emotions about climate change remain small.

Reflection from the study process also leads to review of the role of hope and emotions in CCE as suggested from literature including Ojala's line of research (Ojala, 2012a, 2012b, 2015). When the available evidence on the effects of emotions on students' actions from present study is examined, it appears that the role of emotions is less pivotal than initially expected. The assumption that some students may get overwhelmed by emotions facing climate change have not been supported by observation from this study. It appears students in the study can cope with the stresses and worries associated with climate change to avoid being overwhelmed by negative emotions.

Limited anecdotal evidence from current study also suggested emotions often arise from various learning experience, rather than origin of actions as expected from the previous framework in Figure 1. On the contrary, the central role of hope is evidenced from interviews. As shown by interview data, students' hope about the future of climate change is linked to how they interpret their roles and their personal actions.

As observed from the interview data, the major coping strategies employed by the students were distancing themselves from the issue. The other coping strategies including problem focused coping or meaning focused coping, as suggested by Ojala (2012), were much less observed from limited data in our study.

5.2.2 Hope and denial of climate change ideas

As we study the two types of hope that the surveyed students possessed towards climate change, it was found that *constructive hope* was stronger than *hope based on denial* among the survey students. The results (4.2.3) indicate that overall speaking, most students still remain hopeful climate change can be somehow tackled by humanity via different pathways. Such pathways include new technology advance, global efforts of politicians and various individual and collaborative efforts (Ojala, 2012b, 2015).

However, it was also observed that specific ideas related to denial of climate change were surprisingly common among the surveyed students. One of the most significant observations in the current study was the prevalent confusion regarding the cause of the climate change crisis among the surveyed students. The survey and interview analyses revealed that over one-third of the surveyed students believed that climate change is natural and struggled to associate human activities as the primary cause of climate change. This confusion is reflected in the *hope*

based on denial of climate change subscale in our survey.

While the presence of climate change denial as the psychological coping strategies by *small* percentage of students is already suggested by Ojala (2012b, 2021), the fact that one third of surveyed students in present study share the same idea about climate change denial is still both surprising and alarming for educators.

When studying students with *hope based on denial*, we found that the same students also possessed considerable *constructive hope* toward climate change. In other words, students had *mixed* hope on the future of climate change.

Such mixed hope in climate change in students probably originated from different sources. Regarding the specific idea that contemporary climate change was erroneously considered a natural problem, various possible sources of such misconceptions were considered. As shown by the case of interviewee 09, these misconceptions may have persisted through previous learning or originate from other sources, including different media and peer. Her case exemplifies that psychological coping by young people can be influenced substantially by others in their social circle, including family and peers. (Ojala and Bengtsson, 2019)

As previously explained, human activities are the primary cause of climate change in recent decades, which is a central message in climate change education (CCE) and well-supported by evidence in IPCC reports. Therefore, the observation that nearly one-third of students struggled with anthropocentric climate change may imply significant weaknesses in the CCE received by students in the past.

Additionally, the analysis revealed significant year-by-year differences among students regarding their alignment with various ideas about climate change denial. Specifically, it was found that the year-by-year variations in students' responses were statistically significant for the erroneous idea that climate change is mainly natural. At the time of data collection in 2021, students in their third year of study were comparatively better than more senior students, with fewer students affected by the specific climate denial idea.

There was also one significant difference observed in another denial idea when data between two genders are compared. Among the surveyed students, more male students doubted there is any change in the climate when compared to female students. Ironically, this observation is also consistent with past studies that gender difference existed when it comes to emotion coping strategies and *hope based on denial* (Ojala, 2015; Ojala and Bengtsson, 2019).

Nonetheless, interview data from current study suggests that students first learned about climate change from different subjects during their junior years in secondary school. Given the diverse learning experiences involved in shaping students' perceptions of climate change in both secondary schools and universities, it remains challenging to determine the causes of observed variations based on limited data. Our cases of interview in last chapter suggested that there are plausible explanations for such ideas. Erroneous ideas about climate change may sometimes arise from non-academic sources rather than formal learning experiences in school or university. Notable examples of such sources from our interviews include peers and social media. Given that social media is notoriously easy for dissemination of both accurate and inaccurate information about climate change, learning to discern trustworthy sources of information is therefore a crucial component of CCE.

In this aspect, current study echoes similar observation in recent studies, which show students with limited learning experience in climate change may develop "weird" interpretations of climate change (Hiser & Lynch, 2021). From this perspective, the weird responses from various interviewees may be explained by limited learning experience in climate change education. Their "climate change denial" as expressed in the interview may be explained simply by confusion about the credibility of diverse descriptions of climate change they had received.

However, it is also worth noting that even when students learn about climate change in regular school curriculum, misconceptions about climate change can develop unexpectedly. This phenomenon was exemplified by the case of interviewee 10. While students might recall past learning experience about the impacts of climate change in polar regions many years later, they may still struggle to perceive impacts of climate change in other regions in recent years. Her case confirms finding of past study by O'Neil and Nicholson-Cole (2009) that iconic climate change images about the polar region can capture attention, but can also unexpectedly strengthen the idea that climate change remains a distant issue in far future.

5.2.3 Effects of hope on emotion and perception on learning experience

Our previous analysis of survey data has shown that hope in the future of climate change is linked with significant different emotions toward the same issue. As demonstrated in our analysis (4.2.4.3), grouping based on two types of hope (G1, G2, G3) reveals slightly distinct patterns of emotions towards climate change, with significant differences observed in four emotions: hopeful, joyful, determined, and concerned. In these instances, the mean scores of emotions in the low hope group (G3) were lower than those of the groups with higher hope (G1 and G2). It appears that hope in climate change is associated with how respondents emotionally perceive climate change, with lower hope correlating to lower intensity for at least

these four aforementioned emotions.

There were similar observations from analysis about perception of their past learning experience. When teachers' attitudes in communication styles in secondary schools were used as proxy of how students perceive their past learning experience, there were significant differences between groups based on hope in climate change. As shown in paragraph 4.2.4.1, students with higher hope (groups G1 and G2) scored higher than those with lower hope (group G3) in positive statements about past teachers' attitudes in communication. As previously noted, the results indicated that the three groups were significantly different in four of the positive statements about perceived attitudes of teachers in communication (SSb, SSc, SSd, SSe) and one negative statement (SSf). Results showed that having different hope in climate change also affected how students perceived their past learning experiences, with higher hope associated with more positive perceived attitudes in communication during their study in secondary school.

These findings from present study about different hope reaffirm the findings of original study by Ojala (2015) in local educational context, in which she also found that different hope in climate change can affect how students perceive communication style of teacher among Sweden high school students. Investigate students' hope in climate change can hereby inform university educators on how students perceive their learning.

5.2.4 Climate actions

When asked about the personal actions students as response to climate change, students reported various personal environment friendly actions during interviews in present study, the actions mentioned were mainly related to conservation of energy and resources. However, such actions only corresponded to a very narrow set of possible actions as previously mentioned in

UNESCO's SDG on Climate Action, which was described in chapter 2. (UNESCO, 2007; Carman and Zint, 2020) For instance students hardly made any personal connection to mitigation or adaptation for climate change.

Students interviewed in current study also identified themselves largely as individuals and not as members of larger group when facing climate change. In fact, none of the interview respondents referred to their involvement in or knowledge of community-level actions aside from waste recycling. Community-level collective actions or any form of civic engagement were hardly mentioned at all by all the interviewees in the study. It is possible that even if such opportunities for community-level actions were available, the interviewees may not have been aware of them. Alternatively, the interviewees may have failed to recognize the importance of collective actions at the community level.

If we consider the learning objectives of CCE outlined in SDG of Climate Action (2.3.1.2), then there was not much evidence that the socio-emotional and the behavioral learning objectives were fulfilled by the interviewees. Both of these domains emphasized the importance of collaborative and societal interactions.

This perceived lack of collective responsive actions to climate change at the community level may play a significant role in explaining the general pessimism or passivity of interviewees. (author's opinion) It is explained in the following section.

5.2.5 Reviewing the effects of psychological distancing on students' perceptions

A plausible explanation of students' attitudes in climate action is offered by reviewing the implications of psychological distancing on students' perceptions. Previous analysis of the

interview data revealed that respondents' attitudes towards climate change can be understood largely based on their perceived relationship to climate change. Specifically, it depends on whether they viewed climate change as an issue closely connected to themselves. This phenomenon can be explained using the construal-level theory of psychological distance, as proposed by Trope and Liberman (2010). Four examples illustrating this concept were presented in the following paragraphs.

Similarly, psychological distance can explain why most students responded to climate change with such disparate attitudes. Some students like interviewee 10 believed that climate change was not significantly distinct from other environmental issues, such as ozone layer depletion or pollution issues caused by microplastics or nuclear accidents. Apparently, these students viewed all global environmental issues in a similar manner, as these issues were all equally remote and unrelated to them personally.   Similarly, psychological distancing may also explain why some interviewees like interviewee 07 considered basic environmental actions, such as using fewer plastic bags, to be significant climate actions, despite the tenuous or at best indirect relationship between the two.

Even when students have relatively strong foundation in climate change, psychological distancing may help to explain why the majority of interviewees appear to separate what they have learned from their personal responses to climate change.

Even when some students were convinced of the various local and global effects of climate change, most students could discuss the climate change situation with minimal emotional investment, while responding to the issue with only small adjustments in personal behaviours. Their responses, both in terms of actions and emotions, were surprisingly mild, which did not

provide many indications that a climate crisis is imminent. It is probably that most of the students were maintaining "safe" psychological distances from the issue of climate change.

A second example of the impact of psychological distancing on students' perception of climate change was provided by interviewee 05, who regarded climate change as a future issue that was distant from herself. She held the erroneous belief that climate change would only affect us in the distant future, several decades later. Although this misconception is a common one, it was consistent with her previous memorable learning experience about the impacts of global warming on polar bears living in the distant polar regions. Her experience established that climate change is a distant event, both temporally and spatially.

Interviewee 08 provided the third example of the relevance of psychological distancing. Upon examining the reasons for his heightened emotional investment in the issue of climate change, it became apparent that his country of birth, which is in Asia, was more likely to be severely impacted by climate change. This may explain why he regarded climate change as more personally relevant to him than other interviewees who had been living in a metropolitan city and currently less affected by climate change.

The most compelling example of psychological distancing was demonstrated by interviewee 09. Despite having some prior learning experience about climate change in the secondary school curriculum, her belief about climate change was apparently heavily influenced by her peers. In terms of psychological distance, her peers were closer to her than any academic sources. That may explain why information from her peers was considered more credible than information she had learned from other sources, including academic sources.

The aforementioned examples about psychological distancing are consistent with research conducted in the last two decades on the psychological implications of climate change (Swim et al., 2009; Ojala, 2015). Despite experiencing various learning opportunities over the years, many respondents in our study still perceived climate change as a distant issue that is not particularly relevant to themselves. These examples also remind us even when the teaching and learning experience in CCE is carefully designed, messages from these educational initiatives are still constantly competing for learners' attention against other sources. Therefore, improving the effectiveness of CCE may require strategies aimed at making the learning experience more relevant to learners and more connected to their personal experiences.

In addition to the learners' perspective gained from the survey and interviews, the present study has also analyzed two exemplar lessons of CCE being implemented in university. Upon analyzing two lectures, it is observed that both lessons only addressed the emotional aspects of CCE as secondary considerations or as peripheral issues. References to emotions and hope about climate change were largely absent from the teaching and learning process. Although the teacher in lesson A may have been aware of the negative emotional implications of the climate crisis, pathways for individuals to respond to the situation were limited to certain personal actions in daily life or in the form of international collaboration. Discussions of collaborative actions at the community level were also largely missing in both lectures. There were also few explicit opportunities for students to explore how linkages can be drawn between themselves and climate change.

The ideas of agency thinking and pathway thinking, as suggested by Snyder's theory of hope (2002), have been included in the coding table used in the analysis of the lessons as indicated by the results in table 4.25 and 4.26. The analysis of both lessons also shows these two ideas

corresponding to formation of hope can be given more attention by the educators involved. As mentioned by the experience of Petersen and Barnes (2020), incorporating these ideas can help countering hopelessness in the age of climate crisis.

The above results from analyzing exemplar lessons are largely consistent with results from survey and interviews from the learners' perspectives. Combined together, present study echoed the importance of making CCE relevant for the learners, as summarized by the systematic review of research conducted by Monroe et al. (2017) as described in Chapter two. To establish a genuine connection between students and climate change, pedagogical design should aim at reducing the psychological distance between the learners and the content being taught. This can be accomplished by making climate change more personally relevant to their lives or to people who are significant to them. Other implications to curriculum innovation will be discussed later in this chapter.

5.3 Implications of the study

5.3.1 Relationship between the role of emotions and hope in CCE revisited

Based on the above discussion about emotions, *constructive hope* and learning experiences, the conceptual framework for hope, learning experience and emotion is revised as shown in Figure 9. The relationship between *constructive hope* and climate actions are shown in the lower left branch of the diagram. Also added to the diagram are two important ideas for nurturing *constructive hope* from literature: pathway thinking and agency thinking. Both are linked to the learner's perceptions about climate change.

The implications of psychological coping are also revised in the diagram to include both emotional responses and hope. As suggested by Ojala's line of research, both *constructive hope*

and *hope based on denial* can be interpreted as consequences of the psychologically coping by learner by introducing meaning to the stress and worries when they are facing climate change (Ojala, 2012a, 2012b, 2015). Such interpretation is consistent with our observation that both types of hope exist in learners (as in group G2 in our study).

Figure 9

Revised Conceptual Framework Showing the Relationship between Emotions, Hope and Learning Experience in Climate Change Education (CCE)
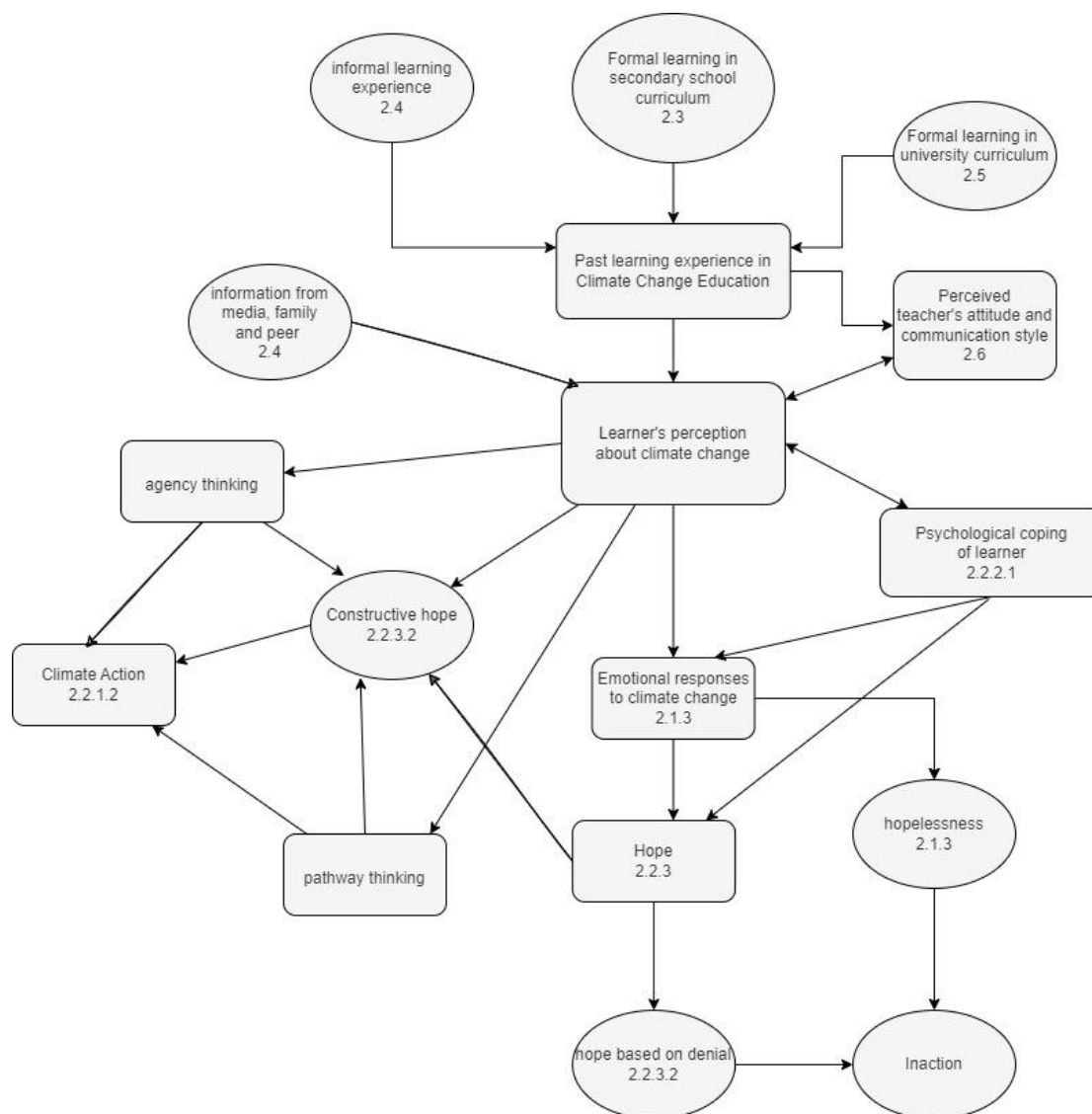
5.3.2 Implications of Hope and Emotions in climate change education in University context

Based on the revised framework understanding about emotions and hope from this study, the implications for CCE in the context of university will be discussed below.

As current survey data on emotions suggested, the prevalence of negative emotions and pessimistic attitudes among the university students towards the future of climate change poses a challenge for CCE. Interview results also suggest negative emotions including powerlessness are common, with most interviewees acknowledged that their individual actions were insufficient to address climate change. It appeared that the perceived responses to climate change were limited to either personal actions or actions taken by governments or at the national level. The concept of responding to climate change through collective actions at the community level was hardly mentioned by the interviewees.

While *constructive hope* is more common than *hope based on denial of climate change* among students, it is important to ensure CCE in university to foster *constructive hope* in students. At the same time, learning in university curriculum should also help students to realize why ideas based on denial of climate change are not consistent with the objective reality.

Given the evidence presented from current study, it is perhaps fair to say the current undergraduate students are not very well equipped in the basis of climate change. In the age of climate crisis, it is important to properly prepare future educators with enough competency in climate change education. As that our current study has provided us some glimpses about the shortcomings of current CCE regarding to handling of emotional aspects, it then follows that

CCE in teacher training programme should be considered as a focused area of curriculum development.

5.3.2.1 Curriculum aspects

Evidence from current study reveal how the emotional aspects of CCE are relevant to design of teaching and learning activities. Therefore, educators at different levels can likely benefit from raising their awareness of these emotional factors. When it comes to topics of hope and emotions and their impacts on learning, expertise from subject disciplines can work together to construct a more pedagogical sound curriculum for climate change education as informed by latest research.

Based on the insights from our study, there are two central ideas that we can incorporate into enhancing CCE in the context of university education. These two ideas are *reducing psychological distance* and *nurturing constructive hope.*

To reduce psychological distance in CCE, educators should make climate change education more *relevant* to the students. Rather than presenting climate change as a distant event occurring in a far-off future, the learning of climate change should emphasize the connections between its various impacts and their proximity to students' lives. To achieve this, a reasonable distribution of learning about the impacts of climate change should be provided in both local and global contexts. Similar arguments can be made for other dimensions of psychological distance, such as the need for a reasonable distribution of learning about climate change from historical to near-future perspectives.

On personal level, students should be provided with opportunities to learn about the impacts of

climate change on their local community, in addition to studying its effects on people in other countries. By doing so, students can better understand the relevance of climate change to their daily lives and become more motivated to take action to address the issue.

For the second idea, CCE in university should focus on nurturing *constructive hope* among undergraduate students. In this aspect, the statements in the *constructive hope* scale have certainly highlighted topics for focused attention of curriculum development. As suggested by present study, formation of *constructive hope* can be benefited from integration of pathway thinking and agency thinking into the curriculum. As mentioned in the literature review, pathway thinking can be enhanced by exploring the various possible options to address climate change. On the other hand, agency thinking can be strengthened by considering personal roles and identities in tackling climate change. Both elements can be given more emphasis during the teaching and learning process of CCE.

It is necessary to investigate how CCE in universities can be adapted to take these two ideas into curricular design. As our analysis of the two exemplar lessons revealed, the affective aspects of the lessons were frequently treated as secondary to the knowledge-based aspects of climate change. While the ideas of pathway thinking and agency thinking are not explicitly presented in the two exemplar lessons, recent examples from other countries suggested these two factors are essential for cultivating more optimistic perspectives in students (Petersen & Barnes, 2020). It may be worthwhile to investigate whether these two elements can be given more emphasis in future CCE curriculum design in current socio-cultural background.

Principles for further curriculum development of CCE can also be gained by re-visiting the recent academic discussion of CCE as covered in chapter 2. Based on the experience

summarized from previous decade on climate change education, Stephen, Nicholas and Whitehouse (2017) have emphasized on the importance of creativity, critical thinking and capacity building in curriculum development in CCE. Based on what our current focus on emotions and hope towards climate change, we can examine how these three elements can be enriched in university undergraduate curriculum.

Among the three elements mentioned in last paragraph, nurturing creativity in learners will certainly help them to gain a future-oriented perspectives on the possibility of solving climate change. Indeed, the prospect of our generation to apply creative problem solving may be the key to find innovative solutions to overcome the challenges posed by climate change. Emphasizing on creativity should therefore likely nurture the *constructive hope* during the learning process. (author's opinion)

The second element suggested by the previously cited paper is critical thinking. As we observed in present study, critical thinking is a crucial element in acquiring a solid knowledge foundation in CCE. Its importance is evident in our discussion of climate change denial. In the context of CCE, students must develop the ability to critically evaluate information and distinguish between reliable sources and propaganda about climate change. This skill will be essential for future teachers to update their knowledge about climate change without being misled by the vast amount of misinformation that is prevalent in contemporary society. In the context of our discussion of different types of hope in climate change, critical thinking combined with self-reflection may facilitate the growth of *constructive hope* and discourage the growth of *hope based on denial*. (author's opinion)

The third element suggested by the same paper is capacity building, which involves increasing

learners' capability to address the challenges posed by climate change. In the context of CCE, capacity building encompasses knowledge, skills, disposition, and values (Stevenson, Nicholls & Whitehouse, 2017). In the context of our discussion of the emotional aspects of CCE, particular attention is drawn to how learners' disposition and values about climate change can be developed gradually throughout the learning process. Given the relevance of emotional factors in the learning process, it is essential for future educators to be aware of their own emotions and hope about climate change. This awareness can facilitate the development of learners' disposition and values regarding climate change and enhance their capacity to address the challenges posed by this critical issue.

As shown by our analysis of two lesson observation sessions, CCE in the current university curriculum targets quite diverse audience due to their backgrounds. Lessons A and B were designed for two distinct groups of undergraduate students. Lesson A is intended for all undergraduate students, whereas Lesson B is designed for students majoring in geography. Therefore, it is reasonable for these two types of CCE lessons to have significantly distinct objectives and focuses. In exploring possible improvement to CCE curriculum, it is necessary to distinguish two distinct directions for enhancing curriculum design: (i) CCE curriculum that aims at all undergraduate students, and (ii) CCE curriculum for specialists. These will be explored in more details in the following two sections.

5.3.2.2 First version of CCE: CCE for all undergraduate students

As we have reviewed the curriculum document of secondary curriculum in Hong Kong in the literature review, the study of climate change can be approached from different chronological perspectives. While anthropocentric climate change is usually considered a contemporary issue, the tradition of discussing climate change from a much longer duration is widely adopted in

different subject disciplines. It may partly explain why some respondents of our current study have some trouble with identifying human activities as the main cause of climate change. This confusion may be more prominent if the students have only very limited background learning experience in climate change. Since this important topic is only given limited coverage in the secondary school subject curriculum in junior secondary school years, only a fraction of students will have chance to study this topic in greater details during their senior years in secondary school. At the same time, the common core subject of Liberal Studies in senior secondary curriculum did not have mandatory content on climate change before the subject was discontinued. It is then nearly unavoidable some students only have limited attainments in this topic. Indeed, this explanation is supported by our observation of the school subject curriculum in the literature review in Chapter 2.

Based on these observations, it is then necessary for CCE in university is to provide a solid foundation in climate change as mandatory part of the curriculum. Regardless of the varied background of students learning in this topic, such foundation is crucial in equipping future educators with the necessary readiness in facing the future challenges posed by climate change. A solid foundation in knowledge about climate change is also essential to prevent misconceptions in climate change.

To ensure that students with various educational background can have a reasonable foundation in climate change, undergraduate programme should include a required course that focuses on the essential knowledge base of climate change. This course should also have sufficient breadth and depth. For the breadth of the course, the content should address the connections between human actions and climate change. This course should also help students understand why human activities play such a crucial role in determining the course of climate change in recent

decades. The depth of the course is necessary for those who have already acquired a foundational understanding of climate change prior to enrolling in university. Students should have ample opportunities to address any lingering doubts or misconceptions regarding this crucial topic. This course should also serve to equip students against the pervasive influence of propaganda and misinformation on social media. It may be advisable for such a course to comprehensively cover the typical arguments, counterarguments, and lobbying techniques employed by climate change deniers.

As noted in the literature review in Chapter Two, the current state of climate change can be worrying even for experts in the field. Nonetheless, if we acknowledge the importance of fostering optimistic attitudes in CCE, it is crucial to structure the curriculum on climate change education around positive messages and *constructive hope*.

In addition to emphasizing the emotional aspects of the curriculum, curriculum development efforts should also incorporate research from educational psychologists. It is important to note that the focus is on raising awareness of emotional aspects in teaching and learning, rather than manipulating emotions.

It would be quite challenging for individual educator to balance the numerous considerations and possess the requisite knowledge to develop such a comprehensive course for CCE. To ensure future teachers possess a comprehensive understanding of climate change, CCE courses should be interdisciplinary as students' understanding about climate change should not be limited by subject boundaries.

The immense complexity of how such a required course should be designed suggests that it

should be a collaborative effort involving diverse expertise. To establish a fact-based curriculum in climate change, experts and academics from various fields should provide input. The spectrum of expertise involved in CCE includes climate science, geography education, science communication, education, and psychology, which are all areas well supported by latest research in academia.

5.3.2.3 Second version of CCE curriculum: CCE for preparing specialists

Given the complexity of CCE, it is important for university educators to consider providing more specialized training for educators who are well-equipped in CCE. Renewed focus should be given to training educators to enhance their competency in CCE. Such a curriculum should provide adequate training in the knowledge basis of climate change education. While geography may be the traditional subject with more curriculum space to deal with the subject knowledge related to climate change, it is necessary to expand the scope of the knowledge basis to include sufficient scientific knowledge that is essential to address the complexity of this issue. To prepare professional teachers for the next generation, curriculum development in the university can start by crossing artificial subject boundaries and assembling transdisciplinary experts. Future educators need to better equip themselves against the epic challenges posed by climate change.

Nevertheless, pushing subject boundaries may not be a straightforward process. The provision of interdisciplinary courses in CCE will require a dedicated team of experts informed by the latest research. In addition to acquiring sound knowledge in climate change, training specialists in CCE should also include cultivating professional competency as educators. This should include enhanced specialized training on specific topics in CCE, including how to address the emotional aspects as explored and identified in the current study.

5.3.3 Pedagogical aspects

By examining the pedagogical aspects of CCE, we can gain valuable insights from our interviews and lesson observations regarding the effectiveness of various pedagogies. While most interviewees had some exposure to climate change education during their secondary school years, the learning experiences varied in format. These formats included storytelling, inquiry-based learning activities, and watching documentary films. A notable characteristic of these profound and memorable episodes was the non-cognitive aspect of the learning process. Although the formats varied, they all emphasized the importance of presenting information about climate change to the audience effectively. The interviewees' recollection of these learning experiences also revealed lingering emotions associated with those memories.

As the third research question attempts to link the current study with the pedagogical aspects of CCE, it is discovered that the two exemplar lectures about climate change only deal with the emotional aspects of CCE indirectly as secondary priorities. These observations remind us again of the limitations of didactic pedagogical approach in CCE. If a teacher must communicate a great deal of information and ideas to students, lectures may arguably be the convenient delivery mode. This mode of delivery is also appropriate for the lecturer to help students to clarify lingering doubts in the complicated topic as climate change. As we observed in lesson B, the lecturer did provide sufficient opportunities for students to pose perplexing questions and have their misconceptions clarified when they surfaced during the learning process. These learning opportunities are essential for establishing a solid foundation of knowledge for climate change education. These are also essential for fostering the critical thinking required in climate change education. For students to acquire an in-depth understanding of climate change, they should be able to pose challenging queries on the subject. In such case, the teacher should also provide the necessary expertise to meet such challenges

in the teaching process.

Nevertheless, our limited lesson observation sessions have also reminded us again that lectures are probably not the best strategy to handling the learning in the related affective domains. We may want to supplement with other more effective teaching strategies in these areas. To shorten the psychological distances between learners and climate change, pedagogy in CCE should also encourage learner to form personal connections with this global issue. Ideally, such connections should be reinforced consistently throughout the learning experience.

As reviewed in chapter 2, the idea of making CCE more relevant to the learners is not a new idea. Indeed, research in environmental education in the last few decades has repetitively explored in length about applying different learner-centered approaches in environmental education (Arik & Yimaz, 2020). Different subject disciplines including science subjects and geography also acknowledged the importance of learner-centered teaching approach. (Wright, 2011) Example of such teaching approach is enquiry-based learning, which has become the core teaching strategies in General Studies in primary school, science subjects and geography in secondary school curriculum. The challenge at hand is therefore explore how to apply such time-tested ideas in renewed curriculum innovation works based on evidence we have.

There are several promising directions for pedagogical innovation in CCE in the university context. Some pedagogical models incorporate the formation of personal connections as part of the learning process. For example, the experiential learning model proposed by Kolb (2014) includes reflection as one of the key stages in the learning process, during which learners have opportunities to draw personal connections with their experiences. Such model is already incorporated in various courses in the university curriculum. Other models, such as problem-

based learning (PBL), can also help students ground their learning in problem solving in authentic real-world situations. However, the limited data collected in this study precludes a comprehensive exploration of other pedagogical models. Curriculum developers may need to base decision about pedagogical models by focusing on how to enhance learners' engagement.

5.3.4 Role of community climate actions in CCE

In the context of present study, there are several plausible explanations for the apparent lack of enthusiasm regarding community-level climate actions. In Lesson B, when discussing public engagement in climate action, the speaker briefly mentioned the importance of collective actions at the local community level but also noted these actions are rare. The speaker further indicated that the Hong Kong community failed to deliberate on the long-term objectives of climate action during the public consultation conducted by the Council for Sustainable Development in 2020. The speaker attributed the lack of public attention to climate change during this period to the social unrest that prevailed in Hong Kong at the time. Despite the fact that the consultation conducted by the Council for Sustainable Development was not the only opportunity for community-level participation in climate action, the public's priorities have largely shifted towards more immediate and pressing local community concerns during these few years.

However, it can be argued that the prevailing sense of powerlessness and helplessness among students strongly suggests the potential for developing a more optimistic narrative through curriculum development. As explored in the literature review, the concept of pathway thinking is an essential component for fostering hope (Snyder, 2002). Although international cooperation is crucial for addressing climate change, young people often do not see their participation in international political forums, such as the IPCC, as relevant. In the context of

climate change education in higher education, the most empowering message that educators can convey to students is that there are numerous ways to contribute to combating climate change. To instill more optimism and *constructive hope* in students about climate change, it is necessary to persuade them that other viable collaborative efforts exist beyond inter-governmental political negotiations. As such, universities can play a role in demonstrating that such collaborative efforts exist and have the potential to be successful, providing a feasible direction for curriculum innovation and planning.

It is suggested that university education can potentially showcase successful instances of collaboration on climate change at the community or societal level. The significance of community-level actions and participation is not a novel concept, as collective actions at this level are commonly discussed within the framework of citizenship. For example, the notion of environmental citizenship links the actions of informed citizens to the collective environmental sustainability objectives of society (Hawthorne & Alabaster, 1999). Actions at the personal level, such as waste recycling, as well as those at the societal level, such as voting and concern for environmental policy, are examples of such citizenship actions. Hence, environmental citizenship can potentially act as the conceptual bridge between personal actions and the social agenda for addressing climate change.

To make CCE authentic, there should be opportunities during the learning process for students to tackle climate change in the community level. Such opportunities would allow student to connect their personal beliefs with their actions that benefit society. Such actions should be facilitated by opportunities to collaborate with others on climate actions at the community level. These actions may entail service-learning and partnerships with external organizations that can provide university students with networks and opportunities to contribute to meaningful

endeavors. As the experience of interviewee 08 demonstrates, negative experiences associated with community-level actions can also unintentionally contribute to learners' feelings of powerlessness. It is therefore important that such community level actions are designed for accumulating sustainable small positive gains, rather than huge but more difficult leaps. These learning projects should enable students to gain positive and fruitful experience while also contributing to the resolution of genuine community issues.

Even if these actions may probably not have large immediate effects on society, they still have significant pedagogical implications for fostering the development of agency thinking in students. It is believed that this development could potentially foster *constructive hope* in students.

5.4 Limitation of research

5.4.1 Methodology issues

This represents a milestone in the multi-year journey to investigate the state of CCE in a specific socio-cultural context. As an interdisciplinary field with diverse research interests, this study delves into various research areas, each with its unique focus, literature basis, research paradigms, and traditions.

Although this research mainly followed a mixed research framework, there were instances where the rigor of data collection was compromised due to pragmatic considerations during its execution. In retrospect, there were certainly numerous opportunities to conduct this research more effectively. The following issues are re-examined to evaluate their implications.

5.4.2 Small sample size

As emphasized throughout this research, the small sample size is a significant weakness of this study. The number of full-time bachelor degree students enrolled in EDUHK in 2020/2021 was over 3600, which included students in both Bachelor of Education and other programmes. (EDUHK, 2022) With fewer than one hundred respondents to the surveys and only ten interviewees, it is presumptuous to assume that these interviewees can represent the vast diversity of students' views in the target population. Despite considerable efforts made during the data collection process to obtain a representative sample, the sample size of this study was still rather small compared to the total population of undergraduate students in the Bachelor of Education program. When combined with a relatively low response rate, the small sample size significantly limits the generalizability of any findings in this study. Statistical analysis of the collected data suggests that the findings of this study are inconclusive.

It is also essential to acknowledge that both surveys and interviews can only collect data from those who are willing to respond. While little is known about the views of non-respondents, it is doubtful that non-respondents are more enthusiastic about climate change education than respondents in this survey.

Regarding the lesson observations, both lessons followed a lecture format dominated by teacher talks. It may be beneficial to conduct similar lesson observations to investigate how emotional aspects of CCE are addressed in other formats of teaching and learning. For instance, courses that adopt service learning and experiential learning place greater emphasis on drawing connections between learning experiences and personal reflection. Such emphasis can facilitate teachers in helping learners to connect their personal experiences with contemporary issues. If similar lesson observations were conducted in such courses, they might reveal differing views

on CCE in the university.

5.4.3 Translation and cultural issues

Translation between English and Chinese in this research has revealed some hints of cultural differences in the traditional of discussion of climate change. These include how emotions are translated from one language to another. My attention is particularly drawn to the subtle differences in the meaning of the emotion of helplessness or hopelessness. The Chinese term used by the interviewees was "無奈" which was translated as hopeless or helpless in the analysis above, but neither translated term seems to capture the original meaning of the interviewees completely in the context. In the interviews, the Chinese term "無奈" was used to convey a sentiment or undertone of being unable to change the situation while passively accepting the undesirable situation. The Chinese term here may have only the implicit meaning of the *absence of hope* which is explicitly stated in the English-translated version. It is hardly the only instance of subtle differences introduced in translation.

My lingering doubts about issues in translation suggest the presence of cultural factors in studying our attitudes toward climate change. On reflection, the above translation problem is just one example where cultural factors are involved in CCE. Indeed, existing studies have already hinted that cultural differences probably contribute to public attitude toward some environmental issues including climate change. (Jylhä, Tam & Milfont, 2021) Further studies may focus on the influence of such cultural factors in the discussion of CCE.

5.4.4 Timing of the research

This research was conducted during 2021, a very special period in Hong Kong. The data

collection was conducted shortly after a year of social unrests, which was followed by a global pandemic caused by COVID-19. While it is likely that these drastic events would likely have psychological and emotional impacts on students, deliberate decisions were taken to exclude these events in current research. The influences from such events were considered as external to my study. Nevertheless, it is unclear whether these mentioned social and global events affected how our targets perceived other global issues such as climate change. Likewise, it is also possible that these events may affect how they viewed the influence of their personal actions.

While there was no direct anecdotal evidence from our study that suggest such influence as described above to be prominent, it is still important to remind ourselves that students' perception may be substantially affected during this very special period. It was during this time when isolation from other people was considered normal. It was also the time when personal concerns including health had taken priority over other more distant issues including climate change. Young adults in this period may likely have experienced a lot of different emotions including fear and anxiety, some of them stronger and more immediate than those towards climate change.

Our discussion about psychological distance can also provide some hints of the impacts of social events and global pandemic. As both events had considerable impacts on local communities, these events were likely to be perceived as quite close to the university students psychologically. It is therefore probable that the emotional impacts of such events may even exceed the impacts from climate change.   I humbly admit that potential influence from such events can only be addressed and verified through separate studies.

Lastly, it is probable that follow-up studies in a few years can provide updates on the emotions and hope of the undergraduate students. Given that the situation of climate change is rapidly evolving, it is likely that data about emotions and hope about climate change will also continue to vary. Capturing these data will likely inform educators on continuous curriculum development in CCE.

5.5 Conclusion

This study represents a significant milestone in my personal efforts to comprehend the present state of CCE at the Education University of Hong Kong. As a member of the educational community and an educator, I am acutely aware of the complexity of factors that may influence the implementation of CCE within this particular educational and socio-cultural context. Given the pragmatic constraints of the research methodology and the highly contextualized perspectives, the lessons learned from this process can only suggest that the dedication of educators is necessary to facilitate future course development in this critical area.

When embarking on this journey, I initially studied the literature on CCE from various countries and discovered that emotions such as worry, hopelessness, and helplessness had become a significant issue in many western countries. Therefore, when constructing the theoretical framework for this research, I anticipated local university students to be worried about climate change. I also expected to encounter students who were overwhelmed by the negative news about climate change and afflicted with feelings of hopelessness and helplessness.

My expectations were somewhat justified when I met some interviewees in the study, particularly Interviewee 08. As a reflective researcher, I was conscious of how I partially

resonated with Interviewee 08 for his emotional investment in the issue of climate change. Not only was he passionate about self-learning more about climate change, but I could also perceive his underlying frustration when he encountered the limitations of one's influence in his learning experience.

Unexpectedly, the case of Interviewee 08 emerged as a unique case primarily based on personal backgrounds. Other interviews conducted in this research revealed that most students, instead of feeling hopeless and helpless, were more inclined to keep the issue of climate change at safe psychological distances. While students were generally concerned about climate change, their personal actions such as recycling and reducing energy consumption were limited. Based on these observations from the current research, most students did not consider it necessary to make drastic changes in their personal actions in respond to climate change. There was little evidence in this study to suggest that students considered climate change as an urgent global crisis that required their special attention. Instead, most students interviewed in the study responded to climate change as if it was just another global issue competing for their attention.

Given the limited pathways by which individual students can contribute to tackling this global issue, it is perhaps hard to fault such perplexing priorities in students. However, such priorities hardly reflect the severity and urgency of the climate crisis. As a member of the university education community, the revealed discrepancy between the severity of climate change and the mild responses of young people is difficult to justify. If we genuinely believe that university education should prepare young people to face the challenges of the future, then the observations from this study urge university educators to coordinate their efforts in CCE curriculum development.

In conclusion, the lessons learned from this study suggest that CCE in the current undergraduate curriculum can be realigned with a renewed understanding of the emotional aspects of CCE. University educators must acknowledge the emotional burdens young people face when confronting the imminent climate crisis. Young people today need to face the challenges and threats posed by imminent climate change while maintaining *constructive hope*. Such challenges require them not only to respond through their personal actions but also to be ready to work together with others. To prepare future educators who are both hopeful and grounded in reality, university curriculum should focus more on making CCE more relevant for the learners. It is suggested that more emphasis should be made to how students should respond to this global issue through collaborative actions in local community context.

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APPENDIX I Writing Task

Questions for writing task:

"We are interested in your _feelings_ and _emotions_ towards climate change. Your response can be any length, from a few lines to several paragraphs. There are no correct answers, please write about the emotions (if any) you feel when you think about climate change. How do you feel about climate change?"

Appendix II Climate Change Education Online Survey

(Researcher's note: For the source of the questions used in this survey, please refer to section 3.5.3.2.)

Q1. Your emotions on climate change

How strongly you experience the following emotions when you are thinking about climate change? (1 = Not at all, to 5 = Strongly)

a. Determined(下定決心)	1	2	3	4	5
b. fascinated(著迷)	1	2	3	4	5
c. hopeful(充滿希望)	1	2	3	4	5
d. apathy(冷漠)	1	2	3	4	5
e. powerless(無力)	1	2	3	4	5
f. overwhelmed(不知所措)	1	2	3	4	5
g. pessimistic(悲觀)	1	2	3	4	5
h. discouraged(灰心)	1	2	3	4	5
i. upset(煩惱)	1	2	3	4	5
j. confused(困惑)	1	2	3	4	5
k. sad(傷心)	1	2	3	4	5
l. concerned(關心)	1	2	3	4	5
m. worried(擔心)	1	2	3	4	5
n. disgusted(噁心)	1	2	3	4	5
o. ashamed(羞愧)	1	2	3	4	5
p. fearful(可怕)	1	2	3	4	5
q. angry(憤怒)	1	2	3	4	5
r. frustrated(沮喪)	1	2	3	4	5
s. surprised(驚訝)	1	2	3	4	5
t. joyful(快樂)	1	2	3	4	5
u. bored(悶)	1	2	3	4	5

(Source: Wang, S., Leviston, Z., Hurlstone, M., Lawrence, C., & Walker, I. (2018). Emotions predict policy support: Why it matters how people feel about climate change. *Global Environmental Change*, *50*, 25-40.)

Q2. Hope on climate change

To what extent do these statements correspond to how you are thinking?"
"not at all= 0" to "very well = 6."

I feel hope concerning climate change….							
a. Because I believe that research and technical solutions will contribute to the improvement of the climate change problem.	0	1	2	3	4	5	6
b. Because I do not think that climate change is as big of a problem as certain researchers claim.	0	1	2	3	4	5	6
c. Because we as individuals can change our behavior, together we can influence climate change in a positive direction.	0	1	2	3	4	5	6
d. Because I believe that climate change is natural and I doubt that climate change is caused by emissions that we humans create.	0	1	2	3	4	5	6
e. Because the awareness about this problem has increased considerably during recent years.	0	1	2	3	4	5	6
f. Because politicians in more and more countries take climate change seriously.	0	1	2	3	4	5	6
g. Because ultimately we will be forced to take climate problems seriously and to take our responsibility.	0	1	2	3	4	5	6
h. Because I doubt that there is any change in the climate.	0	1	2	3	4	5	6
i. Because as long as there are people who are active in environmental organizations there is a possibility that the climate issue will be solved.	0	1	2	3	4	5	6
j. Because I know that there are a number of things that I myself can do to contribute to the improvement of the climate change problem.	0	1	2	3	4	5	6
k. Because I try to focus on positive news about climate change in the media.	0	1	2	3	4	5	6
l. Because I think it's a good thing that the winters in Hong Kong are getting warmer as a result of climate change.	0	1	2	3	4	5	6

(Source: Ojala, M. (2015). Hope in the face of climate change: Associations with environmental engagement and student perceptions of teachers' emotion communication style and future orientation. *The Journal of Environmental Education*, *46*(3), 133-148.)

Q3. Learning experience in climate change
Your gender is   □   Male □   Female

Year of study   □ Year One □ Year Two □ Year Three □Year Four □Year Five

Major area of study:
o   Chinese Language
o   English Language
o   Genera Studies
o   Mathematics (Primary)
o   Physical Education
o   Information and Communication Technology
o   Business, Account and Financial Studies

- o   Mathematics (Secondary)
- o   Early Childhood Education
- o   Chinese History
- o   Geography
- o   Science
- o   Liberal Studies

When did you learn about climate change?
☐ I have not learnt about climate change in any course at university level.
☐ I have learnt about climate change mostly from the courses in this university.

Q4. Regarding to your learning experience <u>in secondary school</u> about climate change.
To what extent do these statements correspond to how you are thinking?"
"not at all= 0" to "very well = 6."

a. I have teachers who take up things that are being done to alleviate various societal and environmental problems, such as political or scientific progress.	0	1	2	3	4	5	6
b. I have teachers who talk about societal and environmental issues in an involved and thought-provoking way.	0	1	2	3	4	5	6
c. I have teachers who take up how you as a young person can alleviate various societal and environmental problems.	0	1	2	3	4	5	6
d. There are teachers who talk about societal and environmental issues in a way that awakens positive emotions in me.	0	1	2	3	4	5	6
e. I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future.	0	1	2	3	4	5	6
f. Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues.	0	1	2	3	4	5	6
g. Most of my teachers often convey an extremely negative and gloomy picture of the future when they talk about societal and environmental issues.	0	1	2	3	4	5	6
h. When it comes to societal and environmental issues, most of my teachers talk almost exclusively about all the terrible things that are happening in the world.	0	1	2	3	4	5	6

(Source: Ojala, M. (2015). Hope in the face of climate change: Associations with environmental engagement and student perceptions of teachers' emotion communication style and future orientation. *The Journal of Environmental Education*, *46*(3), 133-148.)

Q5. Regarding to your learning experience <u>in this university</u> about climate change.
To what extent do these statements correspond to how you are thinking?"
"not at all= 0" to "very well = 6."

a. I have teachers who take up things that are being done to alleviate various societal and environmental problems, such as political or scientific progress.	0	1	2	3	4	5	6
b. I have teachers who talk about societal and environmental issues in an involved and thought-provoking way.	0	1	2	3	4	5	6
c. I have teachers who take up how you as a young person can alleviate various societal and environmental problems.	0	1	2	3	4	5	6
d. There are teachers who talk about societal and environmental	0	1	2	3	4	5	6

issues in a way that awakens positive emotions in me.							
e. I have teachers who in talking about societal and environmental problems in the classroom indicate possible ways to solve those problems in the future.	0	1	2	3	4	5	6
f. Most of my teachers focus primarily on how hopeless everything is when they talk about societal and environmental issues.	0	1	2	3	4	5	6
g. Most of my teachers often convey an extremely negative and gloomy picture of the future when they talk about societal and environmental issues.	0	1	2	3	4	5	6
h. When it comes to societal and environmental issues, most of my teachers talk almost exclusively about all the terrible things that are happening in the world.	0	1	2	3	4	5	6

(Source: Ojala, M. (2015). Hope in the face of climate change: Associations with environmental engagement and student perceptions of teachers' emotion communication style and future orientation. *The Journal of Environmental Education*, *46*(3), 133-148.)

We are going to invite some of the participants in this survey to a follow-up interview in the next few months. Are you willing to join this interview?
☐Yes   ☐ No

Please leave your contact information below. We will contact you if you are selected for the interview. Thanks for your participation.
Name _____
Email _____
Mobile Phone _____

--End of Questionnaire--

Appendix III. Interview Scripts

The following is a list of suggested questions for interview:

(0) Tell me about how you feel about climate change.

你對氣候變化有何感受?

(i) Can you describe what Hong Kong will be like in future regarding climate change? How do you feel about it?

就著氣候變化,請你描述一下,未來的香港會是怎樣的? 你對以上的情況有何感受?

(ii) Can you describe what the world will be like in future regarding to climate change? How do you feel about it?

就著氣候變化,請你描述一下,未來的世界會是怎樣的? 你對以上的情況有何感受?

(iii) Do you think the problems caused by climate change will be solved in the future? If yes, what do you think will happen?

你認為氣候變化引起的問題,在未來會否可以以得到解決?

如果你的答案是「可以」的話,你認為會發生甚麼事?

(iv) What role do you have in related to tackling climate change? Explain briefly.

你認為你在應對氣候變化的過程中,你的角色是甚麼?試解釋一下。

(v) Do you have any personal actions in response to climate change? Can you give some examples of some of your most important climate action?

你是否有任何個人行為回應氣候變化?如果有,請舉例指出你認為最重要的回應氣候變化的行動的例子。

(vi) How do you feel about these actions?

你對以上這些行動有何感受?

(vii) When did you learn about climate change? (Was it before or after you enter university?) Are there any other opportunities in the past?

回顧以前，你是在甚麼時候學習到氣候變化這個課題？（是在進入大學之前還是之後?）除此之外過去還有哪些機會學到氣候變化？

(viii) Regarding to your learning experience before you enter University, which of these learning experience about climate change do you consider most memorable or impactful? Can you give me more details on the learning process?

在你入大學以前，有關氣候變化的學習經驗之中，你認為有哪一些經驗是最難忘，又或者是對你有最大影響的？試詳細描述這一段的學習經驗。

(ix) Regarding to your learning experience after you enter this university, which of these learning experience about climate change do you consider to be most memorable or impactful to you? What have you learnt? Can you describe how did the learning experience happen? How do you feel about this learning experience?

在你入這一間大學以後，有關氣候變化的學習經驗之中，你認為有哪一些經驗是最難忘，又或者是對你有最大影響的？試詳細描述這一段的學習經驗。

你對這一段學習經驗有何感受?

(x) What do you want to learn more about climate change in your study in this university?

對於氣候變化，你會想在這所大學中再學習到甚麼？

(xi) Aside from school and university, have you learnt about climate change from other sources? If yes, then what are these? Can you give us more details about this experience? How do you feel about this experience?

除了中小學及大學的學習以外，你有沒有從其他途徑或機會學習到與氣候變化有關的內容？如有的話是甚麼途徑？請提供與這些學習經驗的詳情。你對這些經驗有何感受？

Appendix IV Codes of Analysis of Interview Scripts

Name	Files	References
climate change denial	3	8
climate change as controversial	1	1
climate change as transitional	1	5
climate change denial - time related	1	2
feeling about action taken	10	28
action as habit	1	1
feeling about action - not much	5	7
feeling about action - positive	3	3
feeling about action taken - mixed	5	6
fulfill personal responsibility	1	1
worry about action not enough	7	10
feeling about climate change	10	51
attribute to personality	1	1
descriptions rather than emotion	5	8

Name	Files	References
feeling about climate change - conflicted	2	2
feeling about climate change - distant	1	2
feeling about climate change - doubt about human action	2	3
feeling about climate change - negative	8	23
emotion of powerless or helpless	6	10
feeling about climate change - confused	1	2
feeling about climate change - miserable	1	1
feeling about climate change - pessimistic	1	1
shocked	1	1
worried about climate change	5	6
feeling about climate change - not much	1	1
feeling about climate change - positive	1	1
feeling about climate change info	1	3
relatable	1	1
sad	1	2

Name	Files	References
feeling about learning process	8	16
feeling about learning process - mixed	2	3
feeling about learning process - negative	4	4
boring	1	1
depressing	1	1
feeling about learning process - positive	5	8
not much	1	1
global impacts of climate change	10	12
abstract descriptions of impacts	3	4
descriptions of abstract change rather than impacts	2	2
correct descriptions of global impacts	4	5
both positive and negative impacts mentioned	1	1
emotions when describing impacts of climate change	1	1
no impacts mentioned	1	1
partial correct in describing global impacts	1	1

Name	Files	References
influence from others	3	5
influence from teacher in the past	2	2
negative feeling about other response	1	1
peer influence-negative	2	2
learning exp related to climate change	7	14
descriptions about learning activities	6	10
exp from other campus activities	2	3
learning experience from outside campus	1	1
learning experience about other issues	2	3
service learning	1	1
local impacts of climate change	10	11
accurate description of local impacts	7	8
describing local situation rather than impacts	2	2
no local change	1	1
path to solving climate change	10	17

Name	Files	References
international collaboration	2	2
only possible to slow down	2	2
passive acceptance	2	2
coexist with climate change	1	1
human will survive	1	1
perceived as difficult to solve	3	4
raised public awareness	3	4
technological means	3	3
personal action	10	21
personal action - less consumption	1	1
personal action - less meat	1	1
personal action - solid waste related actions	3	6
personal action - walking or public transport	3	4
personal action - water and energy conservation	7	8
wear more or less clothing	1	1

Name	Files	References
role and identity	10	23
role as citizen	1	1
role as future teacher	3	4
role as individual	7	9
role as individual as not enough	1	1
role as messenger	1	1
role model	2	2
role to influence other peer and family	1	1
spectator	2	3
source of climate change info	10	38
info from media	2	5
learn from peer	1	1
learning in curriculum	10	17
Curriculum in Secondary school	6	8
textbook	1	1

Name	Files	References
no climate change learning in university	1	1
self-learning	3	6
University course	5	7
want to learn	10	16
nothing further	1	1
want to learn about the controversies about climate change	1	1
want to learn how to influence people	2	2
want to learn more knowledge about climate change	5	5
want to learn through actions	2	2
want to learn what can be done	5	5
more knowledge about international collaboration	1	1