



# How Do Different Framings Of Climate Change Affect Pro-environmental Behaviour?

What Implications Does This Have For Science Education?

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Kandidatspeciale – Climate Change

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# How Do Different Framings Of Climate Change Affect Pro-environmental Behaviour?

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What Implications Does This Have For Science Education?

## Master Thesis In Climate Change Science

Henry James Evans

Supervisors: Marianne Achiam and Jens Dolin

Submitted: 7<sup>th</sup> August 2017



**Name of department:** Department of Science Education  
**Author:** Henry James Evans  
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*Climate change is probably the largest science communication failure in history because climate change has come up against an equally powerful force: human nature.*

Per Espen Stoknes, Norwegian psychologist (Brunhuber, 2016)

# ABSTRACT

With the impacts of climate change now well understood and possible solutions emerging, the way in which climate change is communicated, or framed, plays an important role in changing an individual's behaviour towards the environment. Two such framing methods were investigated in this study – impacts and solutions. Impacts focused on climate change threats facing humanity and solutions focused on technologies and methods to mitigate these threats. To form the project's hypothesis and analyse results, the *fear appeals* theory and the *risky choice framing* effect were used. The project's hypothesis anticipated that impacts framing would lead to a decrease in pro-environmental behaviour whilst a solutions framing would lead to an increase. A questionnaire was devised focussing on topics of transport, water, meat, electricity, recycling, packaging and environmental behaviour. Data was collected from 604 students and 71 teachers in seven international schools throughout south-east Asia including Singapore, Myanmar, Malaysia and Brunei. Pro-environmental behaviour was measured before and after each framing. Both interventions led to a significant increase in pro-environmental behaviour, a result that led to the rejection of the hypothesis. Students and teachers also showed a greater increase in pro-environmental behaviour following the impacts framing rather than solutions framing, which suggests that the *fear appeals* theory is a more effective method for communicating climate change. Results from interviews show that students feel the most suitable form of climate change communication is through a combination of both the impacts and solutions framings. It is suggested that this approach creates a medium level of fear, a finding that agrees with a theory of *fear appeals* called Drive Theory. Further findings will be discussed in terms of age, gender, nationality and climate change beliefs, and their effect on changes in pro-environmental behaviour within respective framings. The implications of the results for science education are then discussed, followed by new hypotheses and further research areas to be explored.



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# CONTENTS

ABSTRACT.....	3
ACKNOWLEDGEMENTS.....	5
LIST OF FIGURES.....	13
LIST OF TABLES.....	17
1.0 INTRODUCTION.....	19
1.1 Aim Of The Study .....	20
2.0 THEORETICAL BACKGROUND.....	23
2.1 Framing Theory.....	23
2.2 Framing Climate Change.....	24
2.2.1 Different Forms Of Framing Climate Change.....	24
2.2.2 School Framing.....	25
2.2.3 Media Framing .....	26
2.3 Fear Appeals Theory .....	26
2.3.1 Drive Theory.....	26
2.3.2 Protection Motivation Theory .....	27
2.3.3 Extended Parallel Process Model.....	27
2.4 Fear Appeals In A Health Context .....	28
2.5 Fear Appeals In A Climate Change Context.....	28
2.6 Different Levels of Fear Appeals .....	29
2.7 Embracing Positive Values And Solutions Framing.....	29
2.8 Note .....	29
3.0 METHODS.....	31
3.1 Preliminary Research .....	31
3.2 Lessons Learnt From The Preliminary Research .....	32
3.3 Project Data Collection .....	33
3.3.1 Pilot Study .....	34
3.3.2 Survey: General Information.....	34
3.3.3 Survey Part One .....	35
3.3.3.1 Question 1, 2 & 3 .....	35
3.3.3.2 Question 4.....	35
3.3.3.3 Question 5.....	36
3.3.3.4 Pro-environmental Behaviour Pre-Framing (Before).....	36
3.3.4 Title Slide.....	37

3.3.5 Basic Climate Science Presentation .....	38
3.3.6 Survey Part Two (Box One) .....	39
3.3.7 Climate Change Framing Presentation .....	39
3.3.7.1 Impacts Framing.....	40
3.3.7.1.1 Temperature .....	40
3.3.7.1.2 Ice-Extent .....	40
3.3.7.1.3 Sea-Level Rise.....	41
3.3.7.1.4 Ocean Acidification .....	41
3.3.7.1.5 Deforestation .....	41
3.3.7.1.6 Fossil-Fuel Subsidies.....	41
3.3.7.1.7 Final Section .....	41
3.3.7.2 Solutions Framing .....	41
3.3.7.2.1 Mitigation.....	42
3.3.7.2.2 Renewables (And Subsidies) .....	42
3.3.7.2.3 Reforestation .....	43
3.3.7.2.4 Politics .....	43
3.3.7.2.5 Technology .....	43
3.3.7.2.6 Co-Benefits.....	43
3.3.7.2.7 Decoupling .....	43
3.3.7.2.8 Globally Responsible .....	43
3.3.7.2.9 Final Section .....	44
3.3.8 Survey Part Two (Box Two) .....	44
3.3.9 Survey Part Three.....	44
3.3.9.1 Pro-environmental Behaviour Post-Framing (After).....	46
3.3.10 Interviews.....	47
4.0 SOCIAL DEMOGRAPHICS .....	49
4.1 General Information .....	49
4.2 Social Demographics Of Students .....	49
4.2.1 Age .....	49
4.2.2 Gender .....	50
4.3 Social Demographics Of Teachers.....	50
4.3.1 Age .....	50
4.3.2 Gender .....	50
5.0 RESULTS.....	51
5.1 General Information .....	51
5.2 Overall Framing Effect On Pro-environmental Behaviour .....	51

5.2.1 Students .....	51
5.2.2 Teachers .....	52
5.2.3 Summary: Overall Framing Effect .....	53
5.3 Framing Effect On Feelings .....	54
5.3.1 General Information .....	54
5.3.2 Students .....	54
5.3.3 Teachers .....	55
5.3.4 Summary: Overall Framing Effect On Feelings.....	56
5.4 Students Age And The Framing Effect .....	56
5.4.1 Age: Twelve Year Olds And Fourteen Year Olds .....	56
5.4.2 Summary: Age .....	57
5.5 Mean Change In Each Pro-environmental Behaviour Category .....	58
5.5.1 General Information .....	58
5.5.2 12 Year Olds .....	58
5.5.3 14 Year Olds .....	58
5.5.4 Summary: Pro-environmental Behaviour Categories .....	59
5.5.5 Further Variables Required .....	59
5.6 Climate Change Importance Of Students .....	60
5.7 Student's Climate Change Beliefs And The Framing Effect.....	60
5.7.1 General Information .....	60
5.7.2 Framing Effect on Pro-environmental Behaviour For Each Category .....	61
5.7.3 Convinced and Unconvinced Categories.....	63
5.8 Student's Gender And The Framing Effect .....	64
5.8.1 Social Demographics .....	64
5.9 Student's Nationality/Location And The Framing Effect .....	66
5.9.1 General Information .....	66
5.9.2 Pro-environmental Behaviour Before And After An Impacts Framing .....	66
5.9.3 Mean Change In Pro-environmental Behaviour .....	67
5.10 Climate Change Knowledge .....	68
5.10.1 Students .....	68
5.10.2 Teachers .....	68
5.11 Interviews.....	68
6.0 DISCUSSION.....	69
6.1 Summary For Readers .....	69
6.2 Overall Framing Effect on Students' & Teachers' Pro-Environmental Behaviour .....	69
6.2.1 Students .....	69

6.2.2 Teachers .....	70
6.3 Fear Appeals.....	70
6.3.1 Pro-environmental Behaviour.....	70
6.3.2 Personal Engagement .....	71
6.3.3 Fear Appeals And Self-Efficacy.....	71
6.3.4 Using Fear Appeals Theory To Help Interpret Results .....	72
6.3.4.1 Drive Theory.....	72
6.3.4.2 Protection Motivation Theory .....	72
6.4 Impacts & Solutions Combined Framing.....	73
6.5 Students Age And The Framing Effect .....	73
6.6 Student’s Gender And The Framing Effect .....	74
6.7 Student’s Nationality/Location And The Framing Effect .....	75
6.8 Student’s Climate Change Beliefs And The Framing Effect.....	76
6.9 Pro-environmental Behaviour Categories .....	76
6.10 Sources of Environmental Information.....	77
6.11 Spillover Effect .....	77
6.12 Limitations And Potential Reasons For Rejecting The Hypothesis .....	77
6.13 Bias.....	79
6.14 Summary: Findings To Improve Science Education .....	79
6.15 New Hypotheses .....	80
6.16 Environmental Awareness .....	80
7.0 CONCLUSION.....	81
8.0 FURTHER WORK .....	83
9.0 REFERENCES.....	85
10.0 APPENDIX .....	91
10.1 Table A18 .....	91
10.2 Table A19 .....	92
10.3 Figure A30.....	92
10.4 Table A20 .....	93
10.5 Table A21 .....	93
10.6 Table A22 .....	93
10.7 Table A23 .....	94
10.8 Table A24 .....	94
10.9 Figure A31 .....	94
10.10 Table A25 .....	95
10.11 (A1) Survey.....	96

10.12 (A2) Interview Questions .....	101
10.13 (A3) Interviews .....	102
10.13.1 (A3.1) Nexus International School, Singapore – 15 <sup>th</sup> March 2017 .....	102
10.13.2 (A3.2) British School of Yangon – 21 <sup>st</sup> March 2017 .....	107
10.13.3 (A3.3) International School of Yangon – 22 <sup>nd</sup> March 2017 .....	111
10.13.4 (A3.4) Network international School, Yangon – 23 <sup>rd</sup> March 2017 .....	113
10.13.5 (A3.5) Kota Kinabalu International School – 29 <sup>th</sup> March 2017 .....	116
10.13.6 (A3.6) International School of Brunei – 6th April 2017 .....	119
10.14 (A4) Presentation slides .....	122
10.14.1 (A4.1) Basic Climate Science Prior To Impacts Framing .....	122
10.14.2 (A4.2) Impacts Framing .....	124
10.14.3 (A4.3) Basic Climate Science Prior To Solutions Framing .....	127
10.14.4 (A4.4) Solutions Framing .....	129



# LIST OF FIGURES

FIGURE 1. THE MODEL OF PROTECTION MOTIVATION THEORY (FROM BOCKARJOVA AND STEG, 2014). .....	27
FIGURE 2. THE AUTHOR OF THE RESEARCH PROJECT, HENRY JAMES EVANS, TEACHING STUDENTS IN THE UNITED ARAB EMIRATES ABOUT THE GREENHOUSE EFFECT IN NOVEMBER 2016. PRESENTATION SLIDE TAKEN FROM IPCC (2007) AND IS SLIDE 6 IN THE BASIC CLIMATE SCIENCE PRESENTATION. THE PROCESS WILL BE DESCRIBED IN DETAIL IN SECTION 3.3.5 (FIGURE 8).....	31
FIGURE 3. THE RESEARCH PROJECT METHOD SPLIT UP INTO THE SEVEN FOLLOWING SECTIONS: SURVEY PART ONE (BEFORE/PRE-FRAMING), BASIC CLIMATE SCIENCE PRESENTATION, SURVEY PART TWO (BOX ONE), IMPACTS OR SOLUTIONS FRAMING PRESENTATION, SURVEY PART TWO (BOX TWO), SURVEY PART THREE (AFTER/POST-FRAMING), INTERVIEWS. IT IS SHOWN FOR EACH SECTION WHETHER IT WAS QUANTITATIVE OR QUALITATIVE DATA BEING COLLECTED, AS WELL AS IF IT WAS A PRESENTATION. ....	34
FIGURE 4. QUESTION 1, 2 AND 3 FILLED OUT BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR WHO HAD THE IMPACTS FRAMING. ....	35
FIGURE 5. QUESTION 4 ASKING ABOUT THE IMPORTANCE OF CLIMATE CHANGE, FILLED OUT BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR WHO HAD THE IMPACTS FRAMING.....	35
FIGURE 6. QUESTION 5 ASKING ABOUT CLIMATE CHANGE BELIEFS, FILLED OUT BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR WHO HAD THE IMPACTS FRAMING. ....	36
FIGURE 7. SEVEN PRO-ENVIRONMENTAL BEHAVIOUR QUESTIONS ON THE TOPICS OF TRANSPORT, WATER, MEAT, ELECTRICITY, RECYCLING, PACKAGING AND ENCOURAGING ENVIRONMENTALLY FRIENDLY BEHAVIOUR. THIS STUDENT EXAMPLE ABOVE STUDIED AT AN INTERNATIONAL SCHOOL IN MYANMAR AND THEIR PRO-ENVIRONMENTAL BEHAVIOUR TOTAL BEFORE FRAMING (PRE-FRAMING) WAS 24 OUT OF 35. ....	37
FIGURE 8. A DIAGRAMMATICAL REPRESENTATION OF THE GREENHOUSE EFFECT (SLIDE 6), SHOWING THE PROCESS OF SOLAR RADIATION TRAVELLING FROM THE SUN TO PLANET EARTH. IT PASSES THROUGH THE ATMOSPHERE, SOME IS ABSORBED BY THE EARTH'S SURFACE, SOME REFLECTS BACK OFF THE EARTH'S SURFACE, SOME RADIATION ESCAPES BACK TO SPACE AND SOME IS TRAPPED IN THE ATMOSPHERE BY GREENHOUSE GASES (TAKEN FROM IPCC, 2007).....	38
FIGURE 9. BOX ONE FILLED OUT DIRECTLY AFTER THE BASIC CLIMATE SCIENCE PRESENTATION BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR WHO HAD THE IMPACTS FRAMING. THEY WRITE: I LEARNED ABOUT THE DIFFERENCE BETWEEN WEATHER AND CLIMATE CHANGE. AND HOW CARBON DIOXIDE WORKS AND WHAT CAUSES IT. ....	39
FIGURE 10. THE OPENING SLIDE OF THE IMPACTS FRAMING OF CLIMATE CHANGE PRESENTATION (SLIDE 13A). CLOCKWISE FROM TOP LEFT: A DROUGHT, A BLEACHED CORAL REEF, A HALF SCORCHED AND HALF GREEN PLANET, A POLAR BEAR STANDING ON AN ISOLATED ICE-FLOW, A COLLAPSING PLANET, POLLUTION FROM A FACTORY AND A DROWNING PLANET. ....	40
FIGURE 11. THE OPENING SLIDE OF THE SOLUTIONS FRAMING OF CLIMATE CHANGE PRESENTATION (SLIDE 13B). CLOCKWISE FROM TOP LEFT: REFORESTATION, WIND-POWER, USING PUBLIC TRANSPORT & CYCLING, SOLAR-POWER, ELECTRIC CARS, GREEN CITIES AND RECYCLING. ....	42
FIGURE 12. BOX TWO FILLED OUT DIRECTLY AFTER THE FRAMING PRESENTATION BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR WHO HAD THE IMPACTS FRAMING. THEY WRITE: I FEEL UNCERTAIN, WORRIED AND ANGRY. ....	44
FIGURE 13. EIGHT BACKGROUND INFORMATION QUESTIONS FILLED OUT DIRECTLY AFTER AN IMPACTS FRAMING BY A STUDENT AT AN INTERNATIONAL SCHOOL IN MYANMAR.....	45
FIGURE 14. SEVEN PRO-ENVIRONMENTAL BEHAVIOUR QUESTIONS ON THE TOPICS OF TRANSPORT, WATER, MEAT, ELECTRICITY, RECYCLING, PACKAGING AND ENCOURAGING ENVIRONMENTALLY FRIENDLY BEHAVIOUR. THIS STUDENT EXAMPLE ABOVE STUDIED AT AN INTERNATIONAL SCHOOL IN MYANMAR AND THEIR PRO-ENVIRONMENTAL BEHAVIOUR TOTAL AFTER FRAMING (POST-FRAMING) WAS 23 OUT OF 35. ....	46

FIGURE 15. PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR 10-17 YEAR OLD STUDENTS BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL OF 604 STUDENTS. IMPACTS = 270 STUDENTS; SOLUTIONS = 334 STUDENTS. PAIRED TWO-TAILED T-TEST. IMPACTS = 269 DF, P<0.01; SOLUTIONS = 333 DF, P<0.01. .... 52

FIGURE 16. PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR TEACHERS BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL OF 71 TEACHERS. IMPACTS = 43 TEACHERS; SOLUTIONS = 28 TEACHERS. PAIRED TWO-TAIL T-TEST. IMPACTS = 42 DF, P<0.0001; SOLUTIONS = 27 DF, P<0.05. .... 53

FIGURE 17. THE OCCURRENCE OF WORDS USED BY STUDENTS AFTER A FRAMING (IMPACTS AND SOLUTIONS) AGED BETWEEN 10-17 IN ANSWER TO THE QUESTION OF HOW DID YOU FEEL DURING THIS PART OF THE PRESENTATION? TOTAL = 604 STUDENTS. IMPACTS = 270 STUDENTS; SOLUTIONS = 334 STUDENTS. (SEE TABLE A18 IN APPENDIX FOR RESULTS TABLE). .... 55

FIGURE 18. THE OCCURRENCE OF WORDS USED BY TEACHERS AFTER A FRAMING (IMPACTS AND SOLUTIONS) IN ANSWER TO THE QUESTION OF HOW DID YOU FEEL DURING THIS PART OF THE PRESENTATION? TOTAL = 71 TEACHERS. IMPACTS = 43 TEACHERS; SOLUTIONS = 28 TEACHERS. (SEE TABLE A19 IN APPENDIX FOR RESULTS TABLE). .... 56

FIGURE 19. THE MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR STUDENTS AGED 12 AND 14 YEARS OLD AFTER A FRAMING (IMPACTS AND SOLUTIONS). 12 YEAR OLDS: IMPACTS = 58 STUDENTS; SOLUTIONS = 145 STUDENTS. UNPAIRED TWO-TAIL T-TEST ASSUMING UNEQUAL VARIANCES. IMPACTS= 57 DF, P=0.75; SOLUTIONS=144 DF, P=0.24. 14 YEAR OLDS: IMPACTS=58 STUDENTS; SOLUTIONS = 8 STUDENTS. UNPAIRED TWO-TAIL T-TEST ASSUMING UNEQUAL VARIANCES. IMPACTS = 57 DF, P=0.0059; SOLUTIONS=7 DF, P=0.32. .... 57

FIGURE 20. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR IN EACH CATEGORY FOR 12 YEAR OLD STUDENTS UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 203 STUDENTS. IMPACTS = 58 STUDENTS; SOLUTIONS = 145 STUDENTS. EF = TO ENCOURAGE FRIENDS AND FAMILY TO ACT ENVIRONMENTALLY FRIENDLY (SEE TABLE A21 IN APPENDIX FOR RESULTS TABLE). .... 58

FIGURE 21. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR IN EACH CATEGORY FOR 14 YEAR OLD STUDENTS UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 66 STUDENTS. IMPACTS = 58 STUDENTS; SOLUTIONS = 8 STUDENTS. EF = TO ENCOURAGE FRIENDS AND FAMILY TO ACT ENVIRONMENTALLY FRIENDLY. (SEE TABLE A22 IN APPENDIX FOR RESULTS TABLE). .... 59

FIGURE 22. STUDENTS' VIEWS ON THE IMPORTANCE OF CLIMATE CHANGE (PRE-FRAMING) AFTER READING THE STATEMENT: ADDRESSING CLIMATE CHANGE IS ONE OF THE MOST IMPORTANT ISSUES FACING SOCIETY TODAY. NA = NOT APPLICABLE. TOTAL = 604 STUDENTS (SEE TABLE A23 IN APPENDIX FOR RESULTS TABLE). .... 60

FIGURE 23. STUDENTS' BELIEFS ON CLIMATE CHANGE (PRE-FRAMING) BY CHOOSING EITHER STATEMENTS A, B OR C. NA = NOT APPLICABLE. TOTAL = 604 STUDENTS (SEE TABLE A24 IN APPENDIX FOR RESULTS TABLE) ..... 61

FIGURE 24. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR STUDENTS FOR EACH CLIMATE CHANGE BELIEF STATEMENT CHOICE WITH A FRAMING. MINUS ERROR BARS WERE REMOVED DUE TO THE LARGE SEM FOR SOLUTIONS B, IMPACTS C AND SOLUTIONS C, TO PREVENT THE GRAPH FROM BEING DISTORTED AND HAVING A NEGATIVE X-AXIS. .... 62

FIGURE 25. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR STUDENTS' CONVINCED AND UNCONVINCED ABOUT CLIMATE CHANGE. TOTAL = 599 STUDENTS. CONVINCED = 551 STUDENTS. UNCONVINCED = 48 STUDENTS. 5 STUDENTS DID NOT ANSWER THE QUESTION (NA). .... 63

FIGURE 26. PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR MALE AND FEMALE STUDENTS BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS). IMPACTS = 141 MALES, 128 FEMALES; SOLUTIONS = 181 MALES, 152 FEMALES. UNPAIRED TWO-TAIL T-TEST ASSUMING UNEQUAL VARIANCES. IMPACTS MALE = 268 DF, P=0.055; IMPACTS FEMALE = 243 DF, P=0.17; SOLUTIONS MALE = 355 DF, P=0.61; SOLUTIONS FEMALE = 301 DF, P=0.12. .... 64

FIGURE 27. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR MALE AND FEMALE STUDENTS BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS). .... 65

FIGURE 28. PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR STUDENTS LOCATED AT TWO INTERNATIONAL SCHOOLS IN MYANMAR WHO HAD THE IMPACTS FRAMING (MYANMAR LOCAL AND



FOREIGN STUDENTS IN MYANMAR). THEY ARE THEN COMPARED TO ALL OTHER STUDENTS WHO HAD THE IMPACTS FRAMING (MAJORITY FROM A SCHOOL IN SINGAPORE). MYANMAR LOCAL = 46 STUDENTS, FOREIGN IN MYANMAR = 40 STUDENTS, ALL OTHER = 184 STUDENTS. PAIRED TWO-TAIL T-TEST. MYANMAR LOCAL = 45 DF,  $P < 0.001$ ; FOREIGN IN MYANMAR = 39 DF,  $P < 0.0001$ ; ALL OTHER = 343,  $P < 0.05$ .

..... 66

FIGURE 29. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN  $\pm$  SEM) FOR MYANMAR LOCAL STUDENTS, FOREIGN STUDENTS IN MYANMAR AND ALL OTHER STUDENTS, ALL WHO HAD THE IMPACTS FRAMING. LOCAL = 46 STUDENTS, FOREIGN = 40 STUDENTS, ALL OTHER = 184 STUDENTS. .... 67

FIGURE A30. PRO-ENVIRONMENTAL BEHAVIOUR FOR STUDENTS AGED 11-14 UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 562 STUDENTS: IMPACTS = 234 STUDENTS; SOLUTIONS = 326 STUDENTS. 11 YEAR OLDS = 65 STUDENTS: IMPACTS = 35 STUDENTS; SOLUTIONS = 29 STUDENTS. 12 YEAR OLDS = 203 STUDENTS: IMPACTS = 58 STUDENTS; SOLUTIONS = 145 STUDENTS. 13 YEAR OLDS = 228 STUDENTS: IMPACTS = 83 STUDENTS; SOLUTIONS = 144 STUDENTS. 14 YEAR OLDS = 66 STUDENTS: IMPACTS = 58 STUDENTS; SOLUTIONS = 8 STUDENTS. .... 92

FIGURE A31. PRO-ENVIRONMENTAL BEHAVIOUR CHANGE FOR EACH CATEGORY FOR MYANMAR LOCAL STUDENTS, FOREIGN STUDENTS IN MYANMAR AND ALL OTHER STUDENTS WHO HAD THE IMPACTS FRAMING. LOCAL = 46 STUDENTS, FOREIGN = 40 STUDENTS, ALL OTHER = 184 STUDENTS. .... 95



# LIST OF TABLES

TABLE 1. THE DIFFERENT METHODS USED IN THE THREE DIFFERENT FRAMING TYPES OF RISKY CHOICE FRAMING, ATTRIBUTE FRAMING AND GOAL FRAMING. (FROM LEVIN, SCHNEIDER AND GAETH, 1998, P151). .....	24
TABLE 2. THE NUMBER OF FRAMING SESSIONS CARRIED OUT TO STUDENTS AND TEACHERS IN THE RESEARCH PROJECT. ....	33
TABLE 3. THE NUMBER OF STUDENTS OF EACH AGE-GROUP FROM 10-17. NA = NOT APPLICABLE.....	49
TABLE 4. THE NUMBER OF MALES AND FEMALES IN THE STUDENTS SAMPLE. NA = NOT APPLICABLE.....	50
TABLE 5. THE NUMBER OF MALE AND FEMALE TEACHERS IN EACH FRAMING. NA= NOT APPLICABLE. ....	50
TABLE 6. DATA FOR STUDENTS' MEAN PRO-ENVIRONMENTAL BEHAVIOUR BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS).....	52
TABLE 7. DATA FOR TEACHERS' MEAN PRO-ENVIRONMENTAL BEHAVIOUR BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS).....	53
TABLE 8. 12 AND 14 YEAR OLD STUDENTS' MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS).....	57
TABLE 9. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR FOR STUDENTS ON THEIR BELIEFS OF CLIMATE CHANGE WITH A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 604 STUDENTS. ....	62
TABLE 10. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR FOR STUDENTS' CONVINCED AND UNCONVINCED ABOUT CLIMATE CHANGE. TOTAL = 599 STUDENTS. CONVINCED = 551 STUDENTS, UNCONVINCED = 48 STUDENTS. 5 STUDENTS DID NOT ANSWER THE QUESTION (NA). ....	63
TABLE 11. THE NUMBER OF MALES AND FEMALE STUDENTS IN EACH FRAMING. IMPACTS = 270 STUDENTS, SOLUTIONS = 334 STUDENTS. TOTAL = 604 STUDENTS. NA = NOT APPLICABLE. ....	64
TABLE 12. MEAN PRO-ENVIRONMENTAL BEHAVIOUR (MEAN ± SEM) FOR MALE AND FEMALE STUDENTS BEFORE AND AFTER A FRAMING (IMPACTS AND SOLUTIONS). ....	65
TABLE 13. MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR FOR MALE AND FEMALE STUDENTS UNDER A FRAMING (IMPACTS AND SOLUTIONS). ....	65
TABLE 14. DATA FOR STUDENTS STUDYING IN MYANMAR, SPLIT INTO LOCAL AND FOREIGN. ALL OTHER STUDENTS ARE ALSO INCLUDED. ALL HAD IMPACTS FRAMING. LOCAL = 46 STUDENTS, FOREIGN = 40 STUDENTS, ALL OTHER = 184 STUDENTS .....	67
TABLE 15. DATA FOR MYANMAR LOCAL STUDENTS, FOREIGN STUDENTS IN MYANMAR AND ALL OTHER STUDENTS WHO HAD THE IMPACTS FRAMING. LOCAL = 46 STUDENTS, FOREIGN = 40 STUDENTS, ALL OTHER = 184 STUDENTS. ....	67
TABLE 16. THE SIX INTERVIEWS CARRIED OUT IN SINGAPORE, MYANMAR, MALAYSIA AND BRUNEI. (FOUR IMPACTS AND TWO SOLUTIONS). TOTAL OF 32 STUDENTS: 14 MALES AND 18 FEMALES. ....	68
TABLE 17. SUMMARY OF ASPECTS OF THE PRESENT STUDY TO HELP THE READER BREAKDOWN THE DISCUSSION. ....	69
TABLE A18. THE OCCURRENCE (%) OF NEGATIVE AND POSITIVE WORDS TO DESCRIBE STUDENT'S FEELINGS AFTER A FRAMING OF CLIMATE CHANGE. TOTAL = 604 STUDENTS. IMPACTS = 270 STUDENTS; SOLUTIONS = 334 STUDENTS. ....	91
TABLE A19. THE OCCURRENCE (%) OF NEGATIVE AND POSITIVE WORDS TO DESCRIBE TEACHER'S FEELINGS AFTER A FRAMING OF CLIMATE CHANGE. TOTAL = 71 TEACHERS. IMPACTS = 43 TEACHERS; SOLUTIONS = 28 TEACHER.....	92
TABLE A20. PRO-ENVIRONMENTAL BEHAVIOUR FOR STUDENTS AGED 11-14 UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 560 STUDENTS: IMPACTS = 234 STUDENTS; SOLUTIONS = 326 STUDENTS. 11 YEAR OLDS = 64 STUDENTS: IMPACTS = 35 STUDENTS; SOLUTIONS = 29 STUDENTS. 12 YEAR OLDS = 203 STUDENTS: IMPACTS = 58 STUDENTS; SOLUTIONS = 145 STUDENTS. 13 YEAR OLDS = 227 STUDENTS: IMPACTS = 83 STUDENTS; SOLUTIONS = 144 STUDENTS. 14 YEAR OLDS = 66 STUDENTS: IMPACTS = 58 STUDENTS; SOLUTIONS = 8 STUDENTS. ....	93

TABLE A21. THE MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR PER CATEGORY FOR 12 YEAR OLD STUDENTS UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 203 STUDENTS. IMPACTS = 58 STUDENTS; SOLUTIONS = 145 STUDENTS. ....	93
TABLE A22. THE MEAN CHANGE IN PRO-ENVIRONMENTAL BEHAVIOUR PER CATEGORY FOR 14 YEAR OLD STUDENTS UNDER A FRAMING (IMPACTS AND SOLUTIONS). TOTAL = 66 STUDENTS. IMPACTS = 58 STUDENTS; SOLUTIONS = 8 STUDENTS. ....	93
TABLE A23. STUDENT PARTICIPANT VIEWS ON THE IMPORTANCE OF CLIMATE CHANGE. TOTAL = 604 STUDENTS. ....	94
TABLE A24. STUDENT PARTICIPANT BELIEFS ON CLIMATE CHANGE. TOTAL = 604 STUDENTS. ....	94
TABLE A25. PRO-ENVIRONMENTAL BEHAVIOUR CHANGE FOR EACH CATEGORY FOR MYANMAR LOCAL STUDENTS, FOREIGN STUDENTS IN MYANMAR AND ALL OTHER STUDENTS WHO HAD THE IMPACTS FRAMING. LOCAL = 46 STUDENTS, FOREIGN = 40 STUDENTS, ALL OTHER = 184 STUDENTS. ....	95

# 1.0 INTRODUCTION

Climate change is now an ever-present global issue that has become an important area of discussion within many sectors all over the world, including between businesses, policymakers and within society (Cismaru *et al.*, 2011). The Earth's climate continues to feel the harmful effects of greenhouse gas emissions released from fossil fuel combustion and via other methods, such as meat production and deforestation. The impacts of climate change have been documented in detail in the released Intergovernmental Panel on Climate Change (IPCC) reports, with scientific evidence pointing towards many changes happening worldwide (such as AR5 by IPCC, 2014), with examples of these including sea-level rise, melting ice-sheets and ocean acidification. 97% of climate scientists agree that humans are primarily the main cause of current and future climate change (Maibach, Myers and Leiserowitz, 2014). The solutions of climate change are an emerging area of research, with a greater amount of money being spent on this field each year, to improve areas such as efficiency and storage. As the price of renewable energy continues to reduce, such as with solar and wind power, this makes them more attractive and financially sensible options to be installed all over the world. Many nations across the world are becoming increasingly reliant on renewable energy, with European examples such as Denmark and the Netherlands. More recently, China has invested heavily in renewable energy installation and is now beginning to lead the way worldwide on climate mitigation.

To raise awareness and increase public knowledge, a large amount of educational effort has been focused on anthropogenic climate change (Bain *et al.*, 2012). Human lifestyles must change to achieve environmental sustainability for Earth (Oskamp, 2002), with greater importance and focus now required on encouraging individuals to engage in pro-environmental behaviour (Riede, Keller and Greissing, 2016). This form of behaviour aims to reduce the "negative impact of one's actions on the natural and built world" (Kollmuss and Agyeman, 2002, p240). The cost of mitigating climate change is felt personally by people worldwide, but the benefits are felt collectively. The behavioural efforts required will affect people's daily lifestyle, as well as the global economy as a whole (Scharks, 2016). Research by the UK Energy Research Centre (UKERC, 2009) showed that behaviour change at the individual level in the UK could lead to a 30% reduction in emissions of greenhouse gases compared to the baseline. This shows the large potential that behaviour change could have (Spence and Pidgeon, 2010). However, behaviour transformation doesn't seem to be occurring worldwide and the number of anthropogenic climate change deniers have even been reported to be on the increase, particularly in countries with high emissions such as Australia (Leviston *et al.*, 2011) and the US (Leiserowitz, 2011).

Many factors regarding climate change and global warming make it very difficult to capture people's interest. These include the difficulty in measuring it and the public uncertainty about whether it is in fact happening. A UK-based study by (Lorenzoni, Nicholson-Cole and Whitmarsh, 2007) investigated the barriers that exist in preventing society from engaging in climate change mitigating behaviour. Examples of their main findings include people having poor knowledge, feeling powerless to make a difference, untrustworthy media, and viewing climate change as an issue far in the future.

A lack of action has led to an increased urgency in communicating messages about climate change and providing more information to the general public. It can be much harder to maintain optimism, if the news is continually framed in a disheartening way (Dilling and Moser, 2007), making the issue seem more psychologically distant. Climate change has been described as the "largest science communication failure in history" (Brunhuber, 2015, p1). To understand how societal feelings are

presented and discussed, framing is becoming an increasingly useful notion (Miller, 2000). Research has shown that an individual's views on climate change, in particular with regards to their mitigating behaviour, is affected by how a message is framed (Busch, 2015). The stances being taken to communicate climate change are clearly not having much success in changing people's behaviour and this has been exacerbated by the "media reporting norms and institutions with vested interests" (Bain *et al.*, 2012, p600). When educating the public, climate change can be framed in many different ways. It is clearly very important to find and fully understand which frames encourage greater support and engagement on policies such as renewable energy and mitigating greenhouse gas emissions.

## **1.1 Aim Of The Study**

This study set out to investigate how different framings of climate change affect pro-environmental behaviour in students aged between 10-17 and also teachers, located at international schools in south-east Asia (Singapore, Myanmar, Malaysia and Brunei). Quantitative and qualitative data were collected, through the use of surveys, presentations and interviews. A range of different variables, such as age, gender, nationality and climate change beliefs will be analysed to further test the effect that framing has on pro-environmental behaviour. The research findings will then be discussed in an educational context and the implications that they may have on science education. Results from this study could possibly lead to some suggested improvements for the environmental and climate change school curriculums, positively changing a student's pro-environmental behaviour and increasing their overall knowledge and awareness on climate change. Most importantly, this research study created a platform for hundreds of students to learn about and discuss climate change, a topic which will play an important part throughout their lives.

This project idea has been formed over the past 12 months, from attaining an enhanced experience of working with students in international schools from the ages of 4-18 years old and conducting workshops on environmental topics, such as climate change and sustainability. Through my own science education business called Magnificent Ocean ([www.magoce.com](http://www.magoce.com)), we work in schools worldwide to educate students on global issues and various other educational topics. During these past experiences, it was noticed that many teachers frame climate change in various ways in the classroom. Some teachers, as well as many students, also had poor climate change knowledge and would repeat many of its common misconceptions, with examples such as linking the ozone layer to climate change, and the use of weather anomalies as evidence for or against climate change. Hence, I decided to include students and teachers in my data collection. Students have been described as being "the decision makers of tomorrow" and their generation compared to any other alive right now, will be more affected by climate change (Riede, Keller and Greissing, 2016, p98). As students become older, they can also directly have a positive influence on the beliefs of their parents, as well as on the decisions that they make (Ballantyne, Connell and Fien, 1998). Families as a whole can also be influenced, as a result of environmentally-based projects conducted by children, known as the spillover effect (Hiramatsu *et al.*, 2014). Our understanding though of the best ways to engage students in climate change is still relatively unknown (Riede, Keller and Greissing, 2016).

Climate change has been framed in this project in terms of impacts: the different threats that humanity is facing associated with a changing climate, and solutions: the mitigation technologies and methods being developed. The hypothesis of this project is that an impacts framing of climate change causes a reduced level of pro-environmental behaviour, while a solutions orientated framing

causes an increased level of pro-environmental behaviour. Research has shown that an impacts framing could lead to a feeling of anxiety, worry and a belief that the issue is now too large to face (O'Neill and Nicholson-Cole, 2009), which will be discussed further within the topic of *fear appeals*. In contrast, solutions framing could lead to a feeling that changing one's behaviour is fully worth doing and that it could make a difference.





## 2.0 THEORETICAL BACKGROUND

In this section, the relevant theories linked to this research project will be covered. Climate change can be framed and disseminated in many different ways and in different settings, such as in schools and in the media. This affects how an individual would perceive the issue and their intention to engage in pro-environmental behaviour.

### 2.1 Framing Theory

Framing is a psychological concept by which the decisions chosen by an individual can be changed if a topic is communicated in different ways. This can be described as a cognitive bias (Plous, 1993). These “interpretive storylines” (Nisbet, 2009, p22) involve an issue being emphasised and others de-emphasised (Nisbet and Mooney, 2007).

*Valence framing* involves information being communicated in either a positive or a negative way and can be explained by prospect theory, which explains how people select choices involving levels of risk (Kahneman and Tversky, 1979). One form of valence framing is known as the *risky choice framing* effect (Tversky and Kahneman, 1981) and is the theory linked to framing most often (Kühberger, 1998). This framing can be discussed in terms of as a loss or a gain (Plous, 1993). Two other forms of *valence framing* are *attribute framing* and *goal framing*, which will be discussed further below.

Tversky and Kahneman, (1981) investigated the *risky choice framing* effect in terms of the consequences of a disease outbreak and different suggested treatments to bring it under control. Their study found that choices involving gains can lead to participants being risk-averse, but that choices involving losses can lead to participants being risk-takers. The gain choice treatments were framed in terms of “lives saved” and can loosely be attributed to a positive framing. The loss choice treatments were framed in terms of “lives lost” and can be loosely attributed to a negative framing. Another example of the risky choice framing effect is by Eraker and Sox, (1981) who carried out a study on drug treatments for patients suffering from symptoms such as chest pain, headaches and hypertension. When the drug treatment choice was positive, such as pain reduction, patient’s behaviour was mostly risk-averse. When the drug treatment choice was negative, such as greater pain, patient’s behaviour was mostly risk-taking.

In relation to this research project, the theory of the *risky choice framing* effect was used to help create the initial hypothesis. An impacts framing of climate change is a negative framing that involves choices of losses (such as cities being flooded, areas of the planet becoming inhabitable and losing biodiversity habitats) that the theory predicts will lead to people being risk-takers and choosing to not engage in pro-environmental behaviour. A solutions framing of climate change is a “positive” framing that involves choices of gains (such as reducing the effects of climate change, improving local water quality and job opportunities), that the theory predicts will lead to people being risk-averse and choosing to engage in pro-environmental behaviour.

*Attribute framing* and *goal framing* (Table 1) both involve just one subject and is very different to the *risky choice framing* described above, which involves a choice between two objects (Krishnamurthy, Carter and Blair, 2001). The main focus of *attribute framing* is the “characteristic of an object or event” and for this it has been hypothesised that a positive framing should be more effective than a negative framing (Levin, Schneider and Gaeth, 1998, p150). A positive and negative

framing could be in terms of a promotion and prevention (Morton *et al.*, no date). Goal framing involves the framing of “the goal of an action or behaviour” and for this, it has been hypothesised that a negative framing should be more effective than a positive framing (Levin, Schneider and Gaeth, 1998, p150). A positive and negative framing could be in terms of satisfactory attributes and unsatisfactory attributes (Morton *et al.*, no date).

Frame type	What is framed	What is affected	How effect is measured
Risky choice	Set of options with different risk levels	Risk preference	Comparison of choices for risky options
Attribute	Object/event attributes or characteristics	Item evaluation	Comparison of attractiveness ratings for the single item
Goal	Consequence or implied goal of a behavior	Impact of persuasion	Comparison of rate of adoption of the behavior

**Table 1.** The different methods used in the three different framing types of risky choice framing, attribute framing and goal framing. (From Levin, Schneider and Gaeth, 1998, p151).

## 2.2 Framing Climate Change

It is very uncertain which form of framing (choice, goal or attribute) can be best associated with the communication of climate change. The impacts of climate change do not involve choices or goals, but both are involved when discussing how we deal with this issue (Morton *et al.*, no date) i.e. the solutions of climate change.

Many different sections of society rely heavily on how climate change is framed and have different reasons for doing so. These include for example, audiences to discuss the issue, journalists to write captivating articles and policymakers on decision making (Nisbet, 2009). It can be incredibly difficult and near impossible to discuss climate change from a neutral stance point (Spence and Pidgeon, 2010) leading to great importance of how the topic is framed (Riede, Keller and Greissing, 2016). The following section will discuss the many different ways that climate change is framed.

### 2.2.1 Different Forms Of Framing Climate Change

When climate change is communicated by educators as an impacts framing at a local level, rather than globally, this generally makes them to be viewed by society as being more serious and important (Dilling and Moser, 2007). This method has a greater chance of increasing engagement on emotive and cognitive terms (Lorenzoni, Nicholson-Cole and Whitmarsh, 2007). Communicators focusing on climate change in terms of local impacts can encourage people to change their behaviour to be more sustainable, due to the positive effects of climate change mitigation thus becoming more relatable and understandable (Rayner and Malone, 1997). A study by Spence and Pidgeon (2010) found that under a gain frame, climate change attitudes in a positive sense increased in greater amounts, compared to under a loss frame. The same trend was also seen with how the severity of climate change impacts is viewed. Health campaigns are often framed in terms of gains

versus losses, such as the use of sunscreen as a gain, versus the associated risks of not applying sunscreen as a loss (Spence and Pidgeon, 2010).

In the past climate change has been framed as being *scientifically uncertain* with the *economic consequences* of mitigation often used as a form of argument by climate sceptics (Nisbet, 2009) or by people who don't view climate change as the most important issue that society faces. An example is the Danish scientist called Bjørn Lomborg, who argued that money could be more effectively spent on other global issues rather than fighting climate change, such as HIV/AIDS and providing clean water worldwide (Jowitz, 2010).

Attempts have been made to counter these framings discussed above, by using a frame that focuses on the climate crisis called *Pandora's Box* (Nisbet, 2009). A commonly used example of this is to frame climate change using words that instigate emotion and to take a catastrophic view of events (Spence and Pidgeon, 2010). Recent films released have presented climate change in an apocalyptic way (Riede, Keller and Greissing, 2016). The film called *The Inconvenient Truth*, a documentary by the former US Vice-President Al Gore, used the concept of "an environmental Frankenstein's monster" to frame climate change (Nisbet, 2009, p19). This can be compared to *The Day After Tomorrow*, which was a Hollywood film released in 2004, and was based more on science fiction. It has been suggested that this method of communication can benefit the climate sceptics, which is the complete opposite from the intended effect it was created to have (Nisbet, 2009). Framing climate change in a scary way has also been aimed directly at children, such as with a UK government-led advert campaign that caused much disapproval. It received over 200 complaints, with the government explaining that a firmer approach was taken due to recent research indicating that the view that climate change will have no effect on them, was shared by more than 50% of the general public in the UK (Sweney, 2009).

A further example of climate change framing is *public accountability*, which is often used by scientists and environmental activists. Another is the *morality and ethics frame*, which has a focus on climate change as a "shared moral challenge" (Nisbet, 2009, p21). Moving climate change framing discussions towards *economic development* has been argued by Nordhaus and Schellenberger (2007) as being the way forward. Economic growth would occur in parallel with fighting climate change, which leads to "sustainable economic prosperity" (Nisbet, 2009, p20).

The framing thought to have the greatest potential to encourage behaviour change is in terms of *public health*. Climate change will cause infectious diseases to be on the increase, with the younger and older populations being most greatly affected. The *public health framing* effect communicates climate change as more applicable and understandable on a personal level. This is due to many infectious diseases already being well known, having a high level of importance in society and can easily be communicated on a local level (Nisbet, 2009). Two different settings for climate change framing will now be discussed; in schools and in the media.

### **2.2.2 School Framing**

Climate change framing occurs in schools, which is of particular relevance to this research project. A study by Riede, Keller and Greissing (2016) investigated the effect of a school project that was focused on the solutions of climate change. Their six month intervention did not significantly change student's awareness and interest in climate change, however it did with regards to energy transition. They state that, "although it cannot be traced back, it appears as a result of the framing approach

applied in this context” (Riede, Keller and Greissing, 2016, p121). A study by Busch (2015) analysed the climate change lessons taught by seven different teachers and found that the frames used could be put into two categories; Science Discourse and Social Discourse. Results showed that the Science Discourse was most commonly used, but was very unlikely to lead to students being encouraged to change behaviour. The Social Discourse was found to be much better at doing this (Busch, 2015).

### **2.2.3 Media Framing**

Environmental topics such as climate change are often framed in different ways by official print, online and televised media. The stance is often taken to give both sides of the argument (acknowledging and rejecting climate change) an equal amount of coverage. This provides an illusion to the viewers that there is still a debate around climate change and that the science isn’t settled, when in fact as already discussed, 97% of climate scientists are in agreement. The media use climate change for their own gain, inflating certain scientific conclusions and adding to the apocalyptic framing of dangerous climate change (Riede, Keller and Greissing, 2016), while also providing a platform for the climate sceptics. (Hulme, 2007) analysed the media coverage by 10 main UK-based national newspapers the day after the IPCC Working Group One (AR4) report was released. Nine of the ten newspapers covered the release of the report, using words such as *catastrophic*, *devastating* and *shocking*. Critically, these words were not included at all in the initial report. It has been suggested that emphasising or exaggerating the level of danger related to an event makes it more newsworthy, by casting it as a direct hazard to society (Weingart, Engels and Pansegrau, 2000). Inflammatory or alarmist language such as this increases readers levels of interest and is a good example of the use of *fear appeals* in the public sphere.

An example of excellent balanced media coverage on climate change and associated topics can be found in the UK based newspaper called The Guardian, specifically on its website. Online they have an Environment section, which has the sub-sections of climate change, wildlife, energy and pollution: <https://www.theguardian.com/uk/environment>

## **2.3 Fear Appeals Theory**

To be able to fully understand how students react to an impacts framing of climate change, it is very important to understand the theories behind *fear appeals*.

*Fear appeals* is aimed at persuading and alarming people to follow a certain path, by explaining the effects of not doing so (Witte, 1992). It has also been referred to as “the language of alarmism” (O’Neil and Nicholson-Cole, 2009, p358) and has been shown to be able to change people’s behaviour (Cismaru *et al.*, 2011), by “promoting precautionary motivation and self-protective action” (Ruiter, Abraham and Kok, 2001, p614). The majority of previous research into *fear appeals* has been based on three theories, which will now be briefly discussed.

### **2.3.1 Drive Theory**

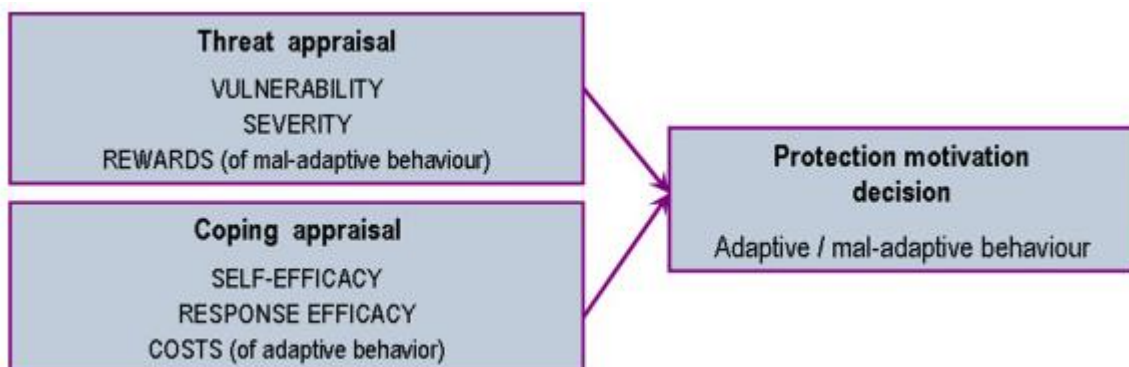
Early studies into fear appeals were conducted using drive theory (Janis and Feshbach, 1953). It was thought that fear created a response. The response to different levels of fear was analysed, with the results showing an inverted U-shaped response. High and low levels of fear caused people to have a

lower intention to change behaviour, but medium levels of fear caused people to have a higher intention to change behaviour. A low threat is caused by a low amount of fear, but a threat level that is far too high is caused by a high amount of fear, leading to a defensive response (Janis and Feshbach, 1953).

### 2.3.2 Protection Motivation Theory

Protection Motivation Theory was created by Rogers, (1975) and assumes that when people make a choice, they weigh up the benefits and risks (Bockarjova and Steg, 2014). At first, Protection Motivation Theory was used to investigate how fear was acted upon by people and to improve the understanding of fear itself (Rogers, 1975). It assumes that when an individual is made aware of a threat, they are told in which ways the threat can be mitigated or evaded (Perloff and Ray, 1991). The advised behaviour will be conducted as long as it is presented in an accessible manner (Cismaru, Lavack and Markewich, 2009).

Protection Motivation Theory comprises of five elements (Figure 1) which affect behaviour and attitudes (Cismaru *et al.*, 2011). These include severity and vulnerability of the issue, the effectiveness of the advised behaviour, self-efficacy and the costs of the advised behaviour (Rogers, 1983).



**Figure 1.** The model of Protection Motivation Theory (From Bockarjova and Steg, 2014).

For climate change communication to be successful, the severity and vulnerability of the issue is raised, self-efficacy and effectiveness of advised behaviour is raised, but the costs of the advised behaviour are reduced (Cismaru *et al.*, 2011).

### 2.3.3 Extended Parallel Process Model

The Extended Parallel Process Model was created to explore what makes *fear appeals* succeed and fail, with this second area being limited in other *fear appeal* theory models (Witte, 1992). The most important elements used in this model are threat (severity & susceptibility) and efficacy (response & self). It predicts that fear is created by a threat, which leads to greater consideration around information on efficacy. Three different results could occur, which are discussed in greater

detail in Scharks (2016). This theory will not be described further, as it will not be used to discuss the results.

## 2.4 Fear Appeals In A Health Context

Protection Motivation Theory was first created to work in issues on health (Cismaru *et al.*, 2011) and the majority of *fear appeals* research is found in this area, which is a very different field of study to climate change. Adverts against smoking commonly use *fear appeals*, with varied results. In some cases, research has in fact shown that these adverts have strengthened the behaviour of smoking (Manyiwa and Brennan, 2012). Here is an example of the boomerang effect mentioned earlier.

## 2.5 Fear Appeals In A Climate Change Context

Climate change is a very different field of study to health. Scharks (2016) writes that it is the wrong approach to communicate these issues using the same methods. *Fear appeal* messages usually involve a threat that has a direct effect on a person. Although climate change does have the potential to threaten individuals here and now, its most serious effects are usually geographically and temporally distant. Some messages are also not about humans at all. Messages are feared in much greater detail if the threat affects you personally (Slovic, Fischhoff and Lichtenstein, 1980), which could partly explain the lack of mitigating climate change behaviour that occurs worldwide (Gifford, 2011). A study by Moser and Dilling, (2004) found that using *fear appeals* with regards to climate change may be detrimental to the message being conveyed on suggested behaviour. Behaviour that is viewed as being counterproductive can be caused by fear, with an example being that it has become common for people who have been made aware of climate change threats, to have a greater aspiration to purchase a sport utility vehicle (SUV). They view this as a way of sheltering them further from the uncertain consequences of climate change that are occurring at present and into the future (FrameWorks Institute, 2001).

A well-used image to depict climate change is a polar bear standing on an isolated and melting ice-floe or ice cap (O'Neill, 2008). A study by O'Neill and Nicholson-Cole (2009) found that the highest levels of engagement in climate change were found when using images and icons that don't threaten, but also spoke to their concerns and emotional feelings. In the study by Spence and Pidgeon (2010) fear responses were found to be lower under the gain frames, compared to the loss frames. This was discussed in the framing Section 2.2.1, with this finding slightly reducing the effect that gain frames had towards climate change attitudes and how the severity of climate change impacts being viewed increased.

*Fear appeals* health messages may be much more effective at changing people's behaviour (Scharks, 2016), compared to those on climate change. However, it is argued that one theory of *fear appeals*, Protection Motivation Theory (described in Section 2.3.2), is extensive enough to be used in any threat situation, such as those involving environmental issues (Floyd *et al.*, 2000). Climate change is an issue of such severity, that it is conceivable that fear will be felt as a consequence of it (Cismaru *et al.*, 2011). In addition, each element of Protection Motivation Theory has been shown in studies to have the ability to change behaviour in relation to climate change (Cismaru *et al.*, 2011; Nisbet, 2009). *Fear appeals* has been shown that it is able to change people's behaviour positively towards mitigation (Cismaru *et al.*, 2011), as well as being very effective at increasing awareness to climate

change. However, it can be a poor method to promote “personal engagement” (O'Neill and Nicholson-Cole, 2009, p355). There have been previous studies on climate change and *fear appeals* which call for further research being required to check how effective this framing method really is (such as O'Neil and Nicholson-Cole, 2009).

## **2.6 Different Levels of Fear Appeals**

By using the example of cancer screening, Jones and Owen (2006) suggested that there might be an optimal level of *fear appeals* in relation to changing someone's behaviour. Messages viewed as being of a high threat level caused very strong negative reactions. Chen (2016) investigated how different fear appeal levels (low, moderate & high) affect someone's likelihood to conduct pro-environmental behaviour. The findings showed that a larger amount of emotive fear was caused by the low-fear appeal message, causing a higher likelihood to conduct pro-environmental behaviour, compared to someone under the high fear level. This finding shows that in this case, the low-fear appeal message was the optimal level of *fear appeals*.

## **2.7 Embracing Positive Values And Solutions Framing**

There appears to be very little literature on this area, calling for a more positive approach to climate change communication and testing it within science education. The great need for this area of research is shown by the lack of interest by the youth of today (Gidley, 2005) towards issues such as the environment. Fear appeals must be coupled with constructive information and support to reduce the danger, while communicators must be encouraged to move away from the “doomsday scenario” (Dilling and Moser, 2007, p75). Instead, they must focus on areas for optimism in terms of “solutions, transitions and resilience” (Nelder, 2013, p293).

## **2.8 Note**

Self-efficacy and collective efficacy are both very important topics to be discussed within this research project, in particular with regards to *fear appeals*. They will be covered in detail in the discussion (Section 6.3.3).





## 3.0 METHODS

The methods used for the collection of quantitative and qualitative data in the school setting are described below, starting with an explanation of how the preliminary research helped form the project's questions and hypothesis.

### 3.1 Preliminary Research

Preliminary data was collected in November 2016 whilst working for Magnificent Ocean in international schools within the United Arab Emirates, in the Middle East. Climate change workshops covering areas such as the basics of the greenhouse effect (Figure 2), the different greenhouse gases and some of the common misconceptions were presented in seven different schools to a total of over 500 students aged between 10 and 16.



**Figure 2.** The author of the research project, Henry James Evans, teaching students in the United Arab Emirates about the greenhouse effect in November 2016. Presentation slide taken from IPCC (2007) and is slide 6 in the basic climate science presentation. The process will be described in detail in Section 3.3.5 (Figure 8).

At the end of each session, a general discussion was held based on the proposition that *assuming humans are the primary cause of global climate change, what can we do about it*. It soon became apparent how valuable this type of discussion is, since each school had clearly taught climate change in different ways. After each session, students were then asked to fill out a short survey in their own time called 'The Climate Change Literacy Survey', with some teachers setting this task as homework. Students were asked questions about their knowledge, opinions and feelings on climate change. Examples questions included:

- Which of the following are greenhouse gases? (choice of carbon dioxide, methane, nitrous oxide and sulphur dioxide)
- How concerned are you about climate change? (open question)
- How will climate change affect you in the future? (open question)

90 students completed the survey and their answers helped lay the foundation for a project investigating the framing of climate change in a school environment and how this might affect student's pro-environmental behaviour.

### 3.2 Lessons Learnt From The Preliminary Research

Due to only 80 out of over 500 students completing the survey, it became clear that the best method would be for students to fill out a survey as part of a session in schools. It would also have been useful to gain similar preliminary data before the session had begun, which could lead to a comparison of the preliminary data collected after the session. It was decided to not just simply investigate students' knowledge and opinions on climate change, as this has been conducted before, for example by Harker-Schuch and Bugge-Henriksen (2013) in an international and national school setting. During the preliminary research, the age-group of 10-16 worked well and the majority already had a basic level of understanding of climate science, with many having previously learnt about it in school. It was deemed from the experience that 11-14 would be the ideal age to work on, due to this age-range seeming to have the most interest in environmental topics and climate change was already being covered in their school curriculums. 65% of students said that they have learnt about climate change in school before, 17% said No and 18% said they were Unsure. The length of the session of around 45-50 minutes was deemed to be a good length of time to work with students and to maintain their attention.

It's important to note that while the setting of the preliminary research was international schools in the Middle East, with many students being from this region, this may certainly have affected results. One answer provided by a student to the question *how concerned are you about climate change?* was the following:

*Student: I am concerned because Yawm al-Qiyamah is coming. I am scared for the future of the earth.*

This is in relation to an Islamic belief involving Allah and The Day of Resurrection, showing the important role that religion can play in this part of the world. Also, while of course the Middle East is a very different location to south-east Asia, where the research project was carried out, all data was collected in international schools. These educational settings often have a very similar ethos towards studying, as well as using similar syllabuses. For example, some schools in both the preliminary data collection and in the present study followed the British curriculum. It was thus deemed acceptable to use the findings from the preliminary research to help shape the present study.

For the question, *which of the following are greenhouse gases?* 85% of students chose carbon dioxide, 69% methane, 29% nitrous oxide and 19% sulphur dioxide. Of these four choices, carbon dioxide, methane and nitrous oxide are all greenhouse gases. Sulphur dioxide is not a greenhouse gas and in fact when in the atmosphere, reflects sunlight which causes a cooling of the atmosphere. These results showed that the level of the presentation was acceptable for this age-group, but could still be improved.

### 3.3 Project Data Collection

The research questions for this project were developed throughout February 2017, finally settling on a study involving climate change, framing and pro-environmental behaviour. Students' behaviour was not being observed, but rather their self-reported willingness to behave in certain ways.

Data collection for the project took place in March and April 2017, over a four-week period during a Magnificent Ocean trip to south-east Asia. Ten international schools were visited across four countries, with these being Singapore, Myanmar (Yangon), Malaysia (Kuala Lumpur) and Brunei (Bandar Seri Begawan). It was decided that the exact same method as given to students, was to be carried out to teachers as well. This study took place in seven out of the ten schools visited on this trip, with these schools interested in having climate change focused workshops, as well as being able to provide the suitable age-groups for the research project. Overall, nine sessions were carried out, comprising of seven student sessions and two teachers sessions. The breakdown of this into impacts framing and solutions framing is shown in Table 2.

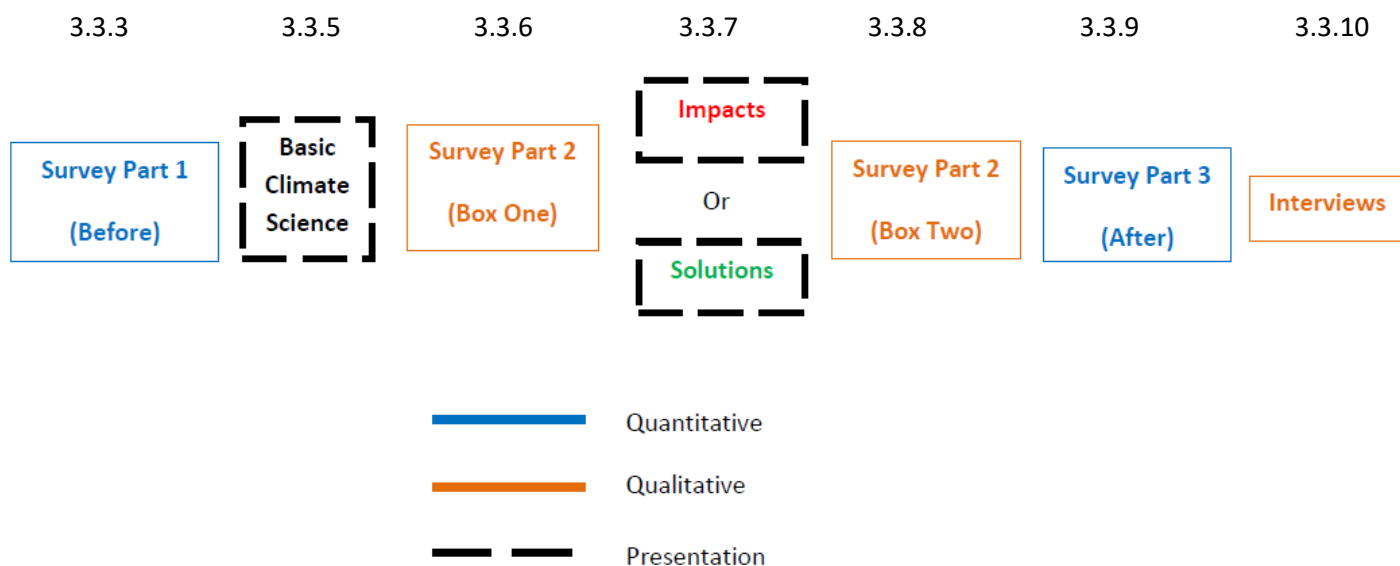
	Impacts	Solutions	Total
Students	4	3	7
Teachers	1	1	2
Total	5	4	9

**Table 2.** *The number of framing sessions carried out to students and teachers in the research project.*

The project method and its seven sections (Figure 3) were created after undergoing a rigorous testing and development process, involving the project supervisors, teachers, students and other people with many different backgrounds. A meeting took place with a Middle School science teacher called Brynna Vogt from Copenhagen International School. The seven sections of the method were discussed, as well as the content of the Basic Climate Science and framing presentations. She had very useful insights and advice from the perspective of a teacher who is very experienced at working in an international school, with the target age-group of the project.

The seven method sections will be described in detail in Sections 3.3.3 – 3.3.10.

## Corresponding sections



**Figure 3.** The research project method split up into the seven following sections: Survey Part One (Before/Pre-Framing), Basic Climate Science presentation, Survey Part Two (Box One), Impacts or Solutions Framing Presentation, Survey Part Two (Box Two), Survey Part Three (After/Post-Framing), Interviews. It is shown for each section whether it was quantitative or qualitative data being collected, as well as if it was a presentation.

### 3.3.1 Pilot Study

The first school visited was used as a pilot study, which was an international school in Singapore. These students had the impacts framing and afterwards only a few minor changes were made to the survey and presentation. The method was very successful at the first attempt, and it was decided that these changes were small enough to allow the data collected to still be used in the overall sample. For example in Part Three of the survey as one of the background information questions, students were asked: *what is the highest level of education that your parents have?* One choice was the term “PhD”, which caused some confusion among students in the pilot study. This was noted and so in the following eight framing sessions, the term “PhD” was always clearly explained to the participants straight after the framing presentation had finished and before they started Part Three of the survey.

### 3.3.2 Survey: General Information

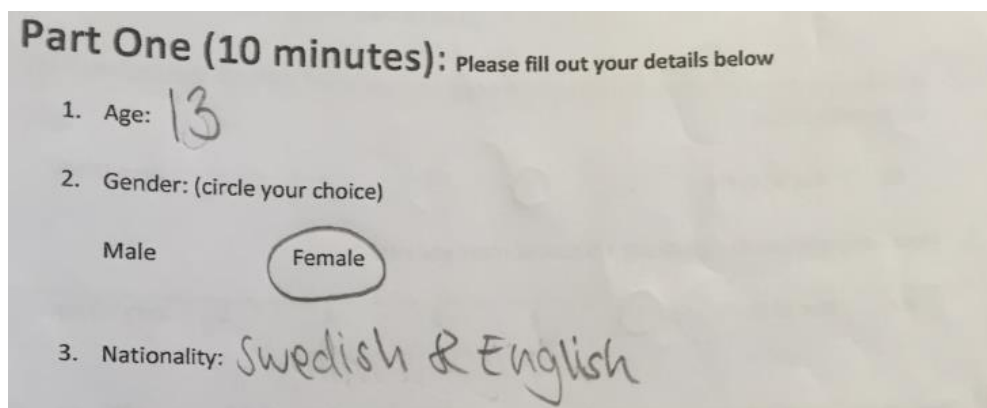
Each student completed a five-page survey, which was split into three parts (Part One, Part Two and Part Three). This format was clearly explained at the start of each session. A full blank version of the survey can be found in Section A1 in the Appendix.

### 3.3.3 Survey Part One

Students were given a maximum of ten minutes to complete Part One of the survey. If all students had finished before this, then the session continued onto the Basic Climate Science presentation.

#### 3.3.3.1 Question 1, 2 & 3

Participants (students and teachers) were asked to fill out their age (open question), gender (Male or Female) and nationality (open question) (Figure 4). It was decided to not ask for names, as this could possibly have led to participants feeling uncomfortable with how their results were to be used and discussed in the project. This could then have potentially affected the choices made in the survey.



Part One (10 minutes): Please fill out your details below

1. Age: 13

2. Gender: (circle your choice)

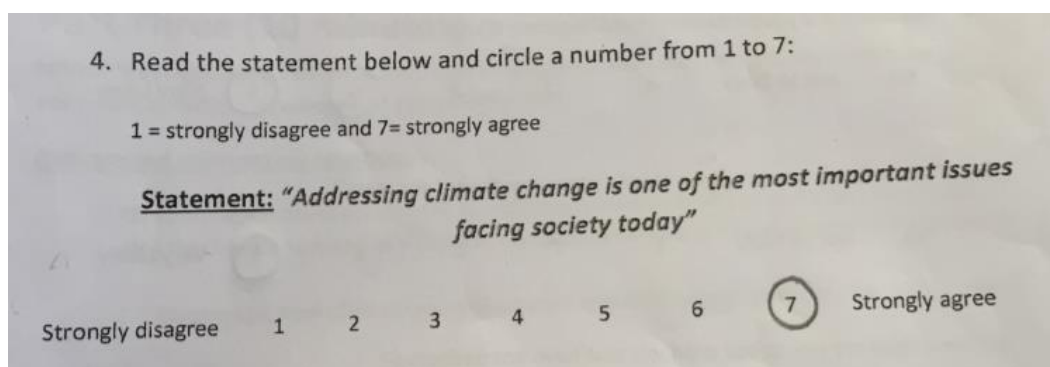
Male  Female

3. Nationality: Swedish & English

**Figure 4.** Question 1, 2 and 3 filled out by a student at an international school in Myanmar who had the impacts framing.

#### 3.3.3.2 Question 4

Participants were then asked about their views on the importance of climate change, by reading the following statement: *Addressing climate change is one of the most important issues facing society today*. Using a seven point Likert scale, they were asked to circle a number from one to seven, with a scale of one equal to *strongly disagree* and seven equal to *strongly agree* (Figure 5). This is a similar method as used in Bain et al., (2015), but a five point Likert scale was used.



4. Read the statement below and circle a number from 1 to 7:

1 = strongly disagree and 7= strongly agree

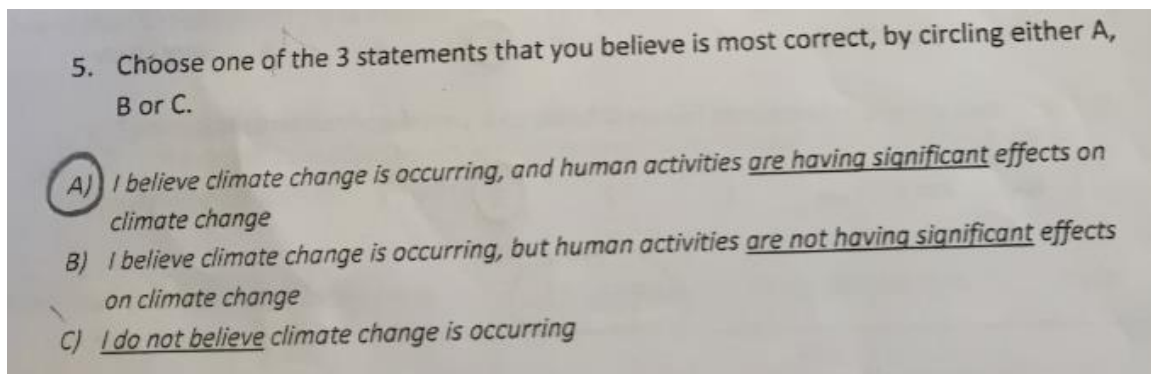
Statement: "Addressing climate change is one of the most important issues facing society today"

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

**Figure 5.** Question 4 asking about the importance of climate change, filled out by a student at an international school in Myanmar who had the impacts framing.

### 3.3.3.3 Question 5

Students were then asked about their climate change beliefs by choosing one of the three statements provided (A, B or C) (Figure 6). This was a similar method used in Bain *et al.*, (2015) with the same way of forming the categories of being *convinced* or *unconvinced* about climate change also used. This will be explained further in Section 5.7.1.



**Figure 6.** Question 5 asking about climate change beliefs, filled out by a student at an international school in Myanmar who had the impacts framing.

### 3.3.3.4 Pro-environmental Behaviour Pre-Framing (Before)

Pro-environmental behaviour was now measured in the form of seven questions and using a five point Likert scale, giving a maximum of 35 points possible for this part of the survey (Figure 7). As a reminder, this study was investigating self-reported willingness to behave in certain ways. The topics were the following: transport, water, meat, electricity, recycling, packaging and encouraging environmentally friendly behaviour. These were taken from the *Personal sphere* behavioural questions used in Bain *et al.*, (2015), in which they used twelve questions overall, but also used a five point Likert scale. It was decided that seven questions was enough for this research project and also to limit the amount of time spent by participants on this part of the survey. The questions around the seven topics used in this survey were changed slightly from Bain *et al.*, (2015), to increase question specificity and the reliability of the answers provided. The questions were also changed to be more relevant to the chosen participants of students and teachers. The same initial question in Bain *et al.*, (2015) of *how likely are you to engage in the following activities in the next 12 months?* was used. An example of a change made to the pro-environmental behaviour question on recycling was changed from just simply *recycling* in Bain *et al.*, (2015), to *how likely are you to recycle plastic, paper, cardboard and glass?*. After completing the survey, students were asked to place it on the floor in front of them and to now focus on the screen in front of them.

1. How likely are you to use the following to travel to school: walk, cycle or use public transport?

NA Not all likely 1 2 3 4 **5** Very Likely

2. How likely are you to reduce the amount of water you use when having a shower/washing up/running a tap?

NA Not all likely 1 **2** **3** 4 5 Very Likely

3. How likely are you to reduce the amount of meat you eat?

NA Not all likely **1** 2 3 4 5 Very Likely

4. How likely are you to turn off electricity when it's not being used?

NA Not all likely 1 2 3 **4** **5** Very Likely

5. How likely are you to recycle plastic, paper, cardboard and glass?

NA Not all likely 1 2 3 4 **5** Very Likely

6. How likely are you to buy products that have less packaging?

NA Not all likely 1 2 **3** 4 5 Very Likely

7. How likely are you to encourage friends & family to act more environmentally friendly?

NA Not all likely 1 2 **3** 4 5 Very Likely

**Figure 7.** Seven pro-environmental behaviour questions on the topics of transport, water, meat, electricity, recycling, packaging and encouraging environmentally friendly behaviour. This student example above studied at an international school in Myanmar and their pro-environmental behaviour total before framing (pre-framing) was 24 out of 35.

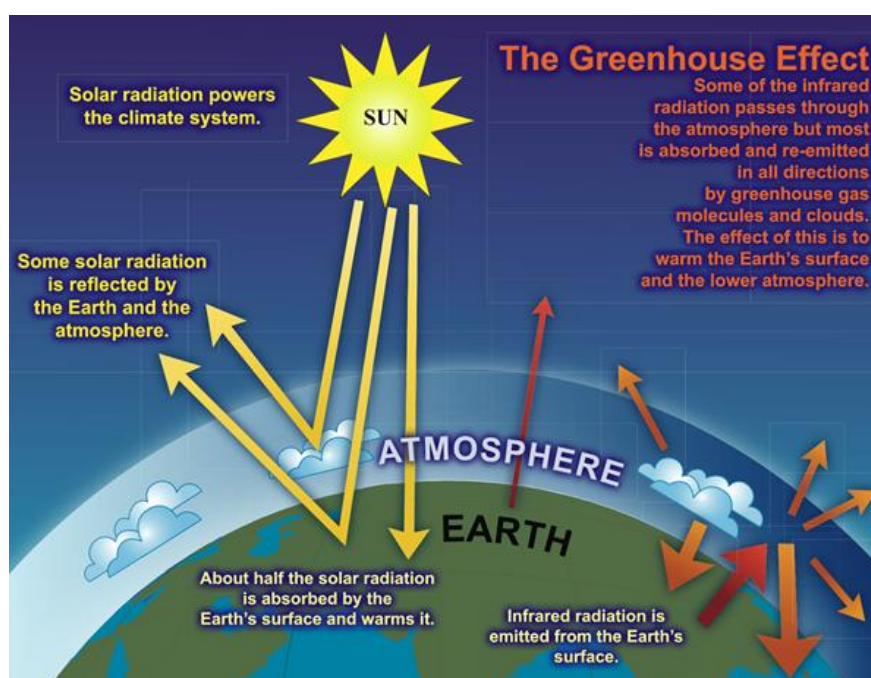
### 3.3.4 Title Slide

The main title of the presentation was “Climate Change & Science Education”. A sub-heading was then either “A Focus on Impacts” (slide 1a) or “A Focus on Solutions” (slide 1b). This meant that students already knew which climate change framing they were about to receive, however they were not made aware that this research project was investigating two different framing forms.



### 3.3.5 Basic Climate Science Presentation

This first presentation part lasted between 15-20 minutes and was conducted to every student and teacher who participated in the data collection. It had eleven slides in total and covered slides two to twelve (A4.1 and A4.3 in Appendix). All scales on graphs were clearly explained to participants. It started with discussing the two questions of *what is weather?* And *what is climate?* (slide 2). Participants were made aware of the differences between them both. Definitions for climate change and global warming were then presented (slide 3). Climate change was discussed in greater detail, bringing in terms such as carbon dioxide and fossil fuels (slide 4). The global scientific consensus of 97% is shown using a pie-chart (slide 5) and before this was revealed, participants were given the chance to provide suggestions for what the answer could be. This helped create an interactive atmosphere to help keep participants engaged throughout. Next, the greenhouse effect was described in great detail using Figure 8, with words such as short-wave, long-wave and infrared radiation being introduced (slide 6).



**Figure 8.** A diagrammatical representation of the greenhouse effect (slide 6), showing the process of solar radiation travelling from the sun to planet Earth. It passes through the atmosphere, some is absorbed by the Earth's surface, some reflects back off the Earth's surface, some radiation escapes back to space and some is trapped in the atmosphere by greenhouse gases (Taken from IPCC, 2007).

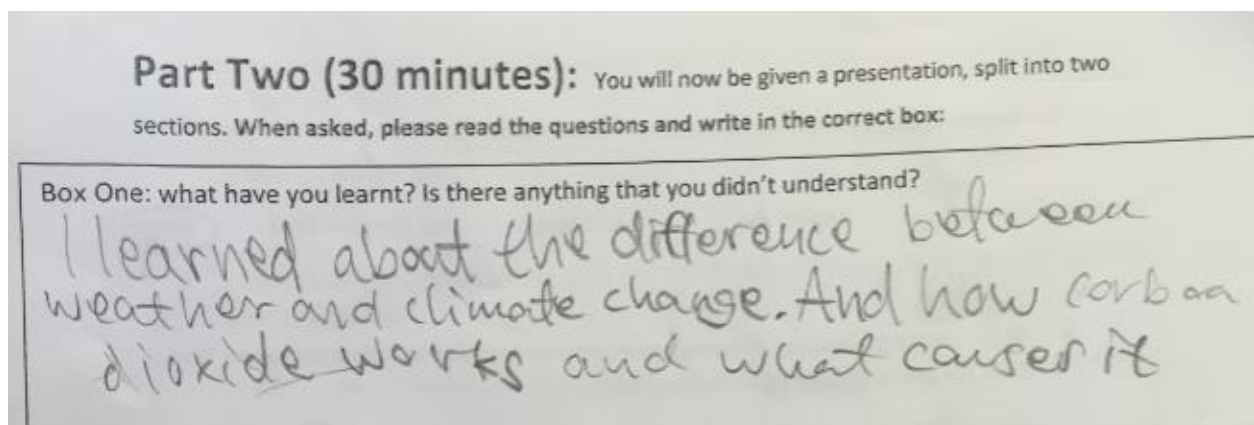
The presentation continued with the three different forms of radiation and the differences between each being discussed: infrared (IR), visible and ultraviolet (UV) (slide 7). The three main greenhouse gases were introduced next: carbon dioxide, methane and sulphur dioxide (slide 8) and the anthropogenic sources of each were covered (slide 9). Graphs were then shown representing how the concentrations of our three main greenhouse gases have changed over the last 40 years from 1975 to 2015 (slide 10). A new term called chlorofluorocarbons (CFC's) is mentioned, with a graph for these concentrations also shown on the same time-scale. The success of the Montreal Protocol, the link of CFC's to the degradation of the ozone layer and how this issue differs massively to that of climate change, are all now discussed. The changing concentrations of carbon dioxide and methane are shown next, using a longer time-scale of the last 10,000 years (slide 11). The term *hockey-stick graph* is now mentioned, focusing on the dramatic increase in concentrations of these greenhouse



gases, which started at the beginning of the Industrial Revolution in the mid-18<sup>th</sup> century. Finally, three common misconceptions of climate change are discussed; the ozone layer, the scientific consensus and weather anomalies (slide 12). This final slide was now left on the screen and the participants were then given their next set of instructions.

### 3.3.6 Survey Part Two (Box One)

Participants were asked to pick up their surveys and to go to Part Two (Box One). They were asked to answer the open questions of *what have you learnt? Is there anything you didn't understand?* (Figure 9). Participants were asked to make sure it was their own work. If the audience noise became too loud, then they were asked to quieten down and focus. Once they had finished, they were asked to put the survey back on the floor in front of them and to make this clear to the presenter. Approximately 30 minutes was designated for Part Two of the survey, which included Box One, the framing presentation (Section 3.3.7) and Box Two (Section 3.3.8).



**Figure 9.** Box One filled out directly after the Basic Climate Science presentation by a student at an international school in Myanmar who had the impacts framing. They write: *I learned about the difference between weather and climate change. And how carbon dioxide works and what causes it.*

### 3.3.7 Climate Change Framing Presentation

The second presentation of the session was now carried out to participants, with each framing lasting 20-25 minutes. Impacts framing had a total of 13 slides (labelled as “a”) and six subjects covered (Sections 3.3.7.1-3.3.7.6), while solutions framing had 14 slides (labelled as “b”) and eight subjects covered (3.3.7.2.1-3.3.7.2.8). Two subjects were covered in both framings, but were discussed by focusing on them in different ways. These were deforestation in the impacts framing and reforestation in the solutions framing; fossil fuel subsidies in the impacts framing and renewable subsidies in the solutions framing. At the end of both framings, it was discussed how someone can make a payment to offset travel emissions, with the money invested into mitigation projects. The example of the main flights used for this research project was discussed, being return flights from Copenhagen via Istanbul to Kuala Lumpur, and the emissions released from these. More information can be found on this in Section 6.16. All scales on graphs were clearly explained to participants.

### 3.3.7.1 Impacts Framing

The impacts framing was from slides 13a-25a (A4.2 in Appendix). The opening slide was a set of images to provide a summary of the impacts of climate change and the different topics that will be discussed in the presentation (Figure 10; slide 13a). The six subjects covered in the impacts framing were temperature, ice-extent, sea-level rise, ocean-acidification, deforestation and fossil fuel subsidies. These will now be discussed in detail.

## IMPACTS OF CLIMATE CHANGE



**Figure 10.** *The opening slide of the impacts framing of climate change presentation (slide 13a). Clockwise from top left: a drought, a bleached coral reef, a half scorched and half green planet, a polar bear standing on an isolated ice-flow, a collapsing planet, pollution from a factory and a drowning planet.*

#### 3.3.7.1.1 Temperature

The global temperature increase was covered from slides 14a to 17a, starting with a graph showing the change over the last 140 years with an annual and five year mean (slide 14a). Next, media coverage examples in the form of drought and land becoming uninhabitable (slide 15a) and the future projected temperature increase using different IPCC model estimates were discussed (slide 16a). Finally, a model on the projection of temperature increase worldwide from 1960 to 2060 was shown (slide 17a). It was explained that the polar-regions are predicted to experience the greatest temperature increases, due to a process called polar amplification, and the global implications of this such as ice-melting and sea-level rise.

#### 3.3.7.1.2 Ice-Extent

The next two slides discussed ice-extent, by showing a graph of the dramatic loss of ice-cover in the Arctic, since data collection began through the use of satellites in 1979 (slide 18a). Media coverage examples that focused on Arctic sea ice-loss were shown, with once again an image of a polar bear being used. Also an article on Antarctic sea ice-loss was discussed (slide 19a).

### **3.3.7.1.3 Sea-Level Rise**

Graphs of past, present and future projections of sea-level rise were shown. The two reasons that sea levels are rising were explained: the melting of land ice and also the thermal expansion of water (slide 20a). Media coverage examples, such as future projected sea-level rise of 6-9 metres and the potential loss of cities within 100 years were discussed, with the city of Venice in Italy being covered in this specific article (slide 21a).

### **3.3.7.1.4 Ocean Acidification**

A graph showing the increasing acidity of the world's oceans is shown, with the formation of carbonic acid and how this leads to corals becoming stressed and bleaching then discussed (slide 22a). The importance of the oceans in absorbing large amounts of carbon dioxide from the atmosphere is also explained. Media coverage examples are given, focusing on the high levels of ocean acidification and the threat that climate change has on the world's corals, such as off the coast of Australia. An image of white dead coral that has bleached is shown (slide 23a).

### **3.3.7.1.5 Deforestation**

A figure showing the deforestation hotspots around the world is shown, with the location of the country that the school is in being covered and if any deforestation was occurring. Examples are, in Malaysia, topics such as palm oil was discussed and in Myanmar, the deforestation occurring in the north of the country was covered. Facts about the Amazon rainforest were discussed, as well as the global deforestation contribution to greenhouse gases being released and a fact about the rate of rainforests being lost (slide 24a).

### **3.3.7.1.6 Fossil-Fuel Subsidies**

Firstly, *what is a subsidy* was discussed. Then a comparison using two pie charts to show the difference in money spent in 2012 on fossil fuel subsidies against renewable subsidies was discussed. The focus was on the large difference in economic amounts being spent, with the amount spent on fossil fuel subsidies being over five times greater (slide 25a).

### **3.3.7.1.7 Final Section**

The opening slide for impacts framing was then shown once again to act as a re-cap (slide 26a). Awareness of being able to pay money to mitigation projects to cover your travel emissions was then covered (slide 27a), as discussed in Sections 3.37 and 6.16. Finally, contact details for Magnificent Ocean and the presenter were shown (slide 28a).

### **3.3.7.2 Solutions Framing**

The solutions framing was from slides 13b to 26b (A4.4 in Appendix). The opening slide was a set of images to provide a summary of the solutions of climate change and the different topics that will be discussed (Figure 11; slide 13b). The eight subjects covered in the solutions framing were mitigation, renewables (and subsidies), reforestation, politics, technology, co-benefits, decoupling and being globally responsible.

## SOLUTIONS OF CLIMATE CHANGE



**Figure 11.** The opening slide of the solutions framing of climate change presentation (slide 13b). Clockwise from top left: reforestation, wind-power, using public transport & cycling, solar-power, electric cars, green cities and recycling.

### 3.3.7.2.1 Mitigation

The definition of the term *mitigation* and its importance within climate change science are discussed, as well as the four different ways in which it can be undertaken (slide 14b). These are the use of new technologies and renewables, making older equipment more energy efficient, changing management practices and changing consumer behaviour.

### 3.3.7.2.2 Renewables (And Subsidies)

Renewable energy is covered from slides 15b to 19b, with the different types first covered, including solar, wind, tidal, hydro, wave and geothermal (slide 15b). Media coverage examples are discussed, such as the success of using wind-power in Denmark and how the price for wind & solar is reducing in relation to the price of fossil fuels (slide 16b). A graph showing the increase in installed renewable energy capacity, from the year 2000-2013 is discussed split up into the six different forms. Bioenergy is mentioned here in detail (green part of bar chart), as it had not been covered previously. It should also be noted that tidal, wave and ocean are grouped together (grey part of bar chart). The four reasons for this cumulative increase are explained: price reducing, storage improvements, the increase in capacity and investment (slide 17b). The same subsidies pie charts from 2012, as was used in the impacts framing (slide 25a) are now shown, with a focus on the large amount of money already being spent on renewables five years ago (slide 18b). The next graph shows the increase in renewable subsidies from the year 2008-2015, as well as also showing the large decrease in fossil fuel subsidies from 2012-2015. The effect that the global economic crash in 2008 had on fossil fuel subsidies can clearly be seen, showing how strongly linked our countries' economies still are to the fossil fuel industry (slide 19b). A discussion is then conducted about the ongoing increasing redistribution of money from fossil fuel to renewable subsidies and how this will affect areas such as price and demand.

#### **3.3.7.2.3 Reforestation**

The role that plants and trees have in acting as a carbon sink through photosynthesis is discussed, along with examples of reforestation projects occurring worldwide. Benefits of reforestation are covered: conserve habitat for endangered and threatened species, improve local water quality, retain top soil and control erosion (slide 20b). A media coverage example is discussed on the story of a teenager called Felix Finkbeiner, who is replanting trees worldwide on an industrial scale (slide 21b).

#### **3.3.7.2.4 Politics**

The Paris Agreement at COP21 back in 2015 and its main goals are discussed. The importance of education (being linked to the session being conducted) and its link to public pressure, and finally to policy change, were explained in great detail. The example of this occurring in China with President Xi Jinping, is discussed, with China now taking a leading role in renewable installation, partially due to public pressure from pollution in cities such as Beijing. This is compared to the current on goings within the US government and President Donald Trump. The importance of the US and China climate change deal in the run up to the Paris Agreement is also covered (slide 22b).

#### **3.3.7.2.5 Technology**

Examples of technological improvements with regards to mitigation and renewables are discussed here. These include the solar tile developed by Tesla, the increase in the manufacturing of electric cars, price reduction, demand and its effect on these technological solutions now becoming financially sensible options for companies and individuals worldwide (slide 23b).

#### **3.3.7.2.6 Co-Benefits**

Six co-benefits that can be gained globally by mitigating climate change are listed here and discussed in detail: reduce the global impacts of climate change, better air quality, improved global health, more equal society, job opportunities and a moral and caring society (slide 24b).

#### **3.3.7.2.7 Decoupling**

The term decoupling is explained in detail, using a graph showing how between 1990-2013, Sweden's GDP has increased, while at the same time its carbon dioxide emissions have decreased. The reasons for this are discussed, such as the increasing investment in renewable technologies (slide 25b). For the past 200 years, a country's GDP has always been coupled with its carbon dioxide emissions, but this is now beginning to change worldwide.

#### **3.3.7.2.8 Globally Responsible**

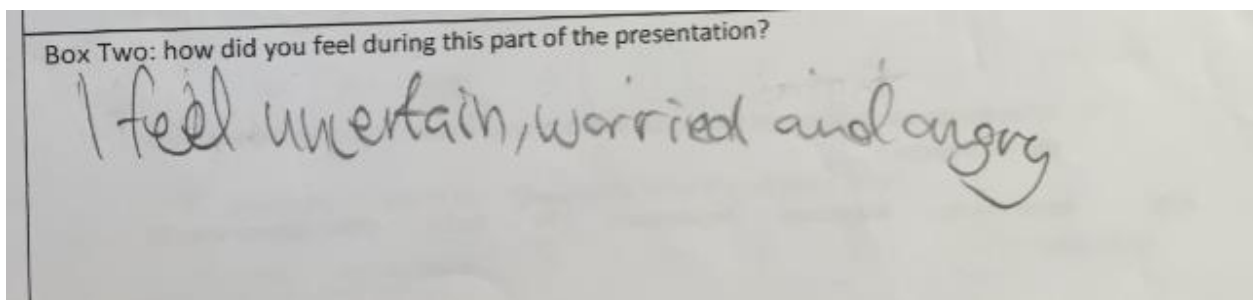
This slide aims to make each participant feel responsible for their actions and creates a discussion towards how an individual can reduce their carbon footprint, as well as why they should even consider doing so (slide 26b).

### 3.3.7.2.9 Final Section

The opening slide for solutions framing with images was then shown once again to act as a re-cap (slide 27b). Awareness of being able to pay money to mitigation projects to cover your travel emissions was then covered (slide 28b), as discussed in Sections 3.37 and 6.15. Finally, contact details for Magnificent Ocean and the presenter were shown (slide 29b).

### 3.3.8 Survey Part Two (Box Two)

Participants were asked to pick up their surveys and to go to Part Two, (Box Two). They were asked to answer the open question of *how did you feel during this part of the presentation?* (Figure 12). It was made clear that this was asking in relation to the framing presentation that they had just received. The same rules were applied as for when they answered Part Two (Box One) (Section 3.3.6).



**Figure 12.** *Box Two filled out directly after the framing presentation by a student at an international school in Myanmar who had the impacts framing. They write: I feel uncertain, worried and angry.*

### 3.3.9 Survey Part Three

In the final part of the survey, participants were asked to answer background information questions in relation to environmental issues (Figure 13).

**Part Three (10 minutes):** After the presentation has finished, answer the following background questions below. Then once again answer the same pro-environmental behaviour questions, as were asked earlier in Part One.

**Background information questions**

\*Environmental issues are defined as problems with the planet's systems (air, water, soil, etc.) that have developed as a result of human interference or mistreatment of the planet.

1. On average, how often do you discuss environmental issues\* with your family per week?

More than 5 times      3 to 4 times      1 to 2 times      Less than one time      **Never**

2. On average, how often do you discuss environmental issues\* in the classroom with teachers per week?

More than 5 times      3 to 4 times      **1 to 2 times**      Less than one time      Never

3. On average, how often do you discuss environmental issues\* with your friends per week?

More than 5 times      3 to 4 times      1 to 2 times      Less than one time      **Never**

4. While watching television at home and an environmental programme comes on, how likely are you to change to something else?

NA      Not at all likely      1      2      3      4      **5**      Very likely

5. What do you use to learn and read about environmental issues\*? (You can choose more than one option.)

N/A      Social media      Magazines      Newspapers      **TV**      Radio      Other (please specify)

6. Have you learnt about climate change before in school?

**Yes**      No      Unsure

7. How likely are you to work on the protection of the environment in the future? (As a job, volunteering etc).

Not at all likely      1      **2**      3      4      5      Very likely

8. What is the highest level of education that your parents have?

N/A      Primary school      Secondary school      College/Sixth Form  
Undergraduate      Postgraduate      PhD      Other (please specify)

I don't know

**Figure 13.** Eight background information questions filled out directly after an impacts framing by a student at an international school in Myanmar.



### 3.3.9.1 Pro-environmental Behaviour Post-Framing (After)

After this, participants repeated the seven pro-environmental behaviour questions using the same five point Likert scale and were asked specifically to not look back at their answers written earlier in Part One. This student used as an example to explain the method, had a pro-environmental behaviour rating (After/Post-framing) of 23 out of 35 (Figure 14). Their pre-framing points were 24 (Section 3.3.3.4, Figure 7), meaning that the impacts framing caused a reduction in pro-environmental behaviour of 1.

1. How likely are you to use the following to travel to school: walk, cycle or use public transport?

NA Not all likely 1 2 3 4 5 Very Likely

2. How likely are you to reduce the amount of water you use when having a shower/washing up/running a tap?

NA Not all likely 1 2 3 4 5 Very Likely

3. How likely are you to reduce the amount of meat you eat?

NA Not all likely 1 2 3 4 5 Very Likely

4. How likely are you to turn off electricity when it's not being used?

NA Not all likely 1 2 3 4 5 Very Likely

5. How likely are you to recycle plastic, paper, cardboard and glass?

NA Not all likely 1 2 3 4 5 Very Likely

6. How likely are you to buy products that have less packaging?

NA Not all likely 1 2 3 4 5 Very Likely

7. How likely are you to encourage friends & family to act more environmentally friendly?

NA Not all likely 1 2 3 4 5 Very Likely

**Figure 14.** Seven pro-environmental behaviour questions on the topics of transport, water, meat, electricity, recycling, packaging and encouraging environmentally friendly behaviour. This student example above studied at an international school in Myanmar and their pro-environmental behaviour total after framing (post-framing) was 23 out of 35.



### **3.3.10 Interviews**

At the end of each session, roughly five students were chosen from the audience with the help of teachers who had been pre-informed about the following requirements: a mix of age (dependent on age-range of audience), gender, knowledge and nationality. The chosen students were told to meet at a certain time and place later that day, which was usually in their lunch-break. Once everyone had arrived, the students were given five minutes to look at seven questions and were asked to think about their own answers. The interview was then audio recorded using an iPhone 6 with an informal and friendly atmosphere created, to allow the students to feel relaxed and so more likely to speak their mind. Teachers were not interviewed, due to their limited availability and the project time restraint. The interview questions are found in A2 in the Appendix.



# 4.0 SOCIAL DEMOGRAPHICS

## 4.1 General Information

A total of 742 participants took part in the research project, comprising of 667 students and 75 teachers. Approximately 60% of the participants completed print surveys, while approximately 40% completed online surveys. The online survey was created on Google classroom, with participants either bringing their own devices to the session, or the school providing the resources.

Any participant who had not answered any of the pro-environmental behaviour questions in either Part One (Before/Pre-framing) or Part Three (After/Post-framing) of the survey were removed from the sample. To be included, at least one of the pro-environmental behaviour questions had to be answered in both parts. 67 participants were removed from the sample, comprising of 63 students and 4 teachers. The 675 participants leftover were made up of 604 students and 71 teachers. 59 different nationalities were represented across six continents.

## 4.2 Social Demographics Of Students

The impacts framing was carried out to 270 students (44.7%) and the solutions framing to 334 students (55.3%). The two framing interventions were not carried out 50:50 (to the same number of students), due to the study being constrained to give whole classes at a school one treatment or the other. No student received both framings.

### 4.2.1 Age

The total age range of students was 10-17, with 93% (562 students) being 11-14 year olds (Table 3). The age range of students in the impacts framing was 10-17 and 11-16 in the solutions framing.

Age (Years)	Number of students
10	7
11	65
12	203
13	228
14	66
15	24
16	6
17	1
NA	4
Total	604

**Table 3.** *The number of students of each age-group from 10-17. NA = Not Applicable.*

### 4.2.2 Gender

A relatively equal spread of male and female students were represented in the sample (Table 4). The breakdown of genders in each framing will be covered in further detail in section 5.8.

	Male	Female	NA	Total
Number of Students	322	280	2	604

**Table 4.** *The number of males and females in the students sample. NA = Not Applicable.*

## 4.3 Social Demographics Of Teachers

The impacts framing was carried out to 43 teachers (60.6%) and the solutions framing to 28 teachers (39.4%). The two framing interventions were not carried out 50:50 (to the same number of teachers), due to the same reason above given for students.

### 4.3.1 Age

The total age-range of teachers was 20-68. The age range of teachers in the impacts framing was 20-46 and 24-68 in the solutions framing.

### 4.3.2 Gender

25 male teachers and 45 female teachers participated in the study. The breakdown of genders in each framing is shown in Table 5.

	Male	Female	NA	Total
Impacts	13	29	1	43
Solutions	12	16	0	28
Total	25	45	1	71

**Table 5.** *The number of male and female teachers in each framing. NA= Not Applicable.*

# 5.0 RESULTS

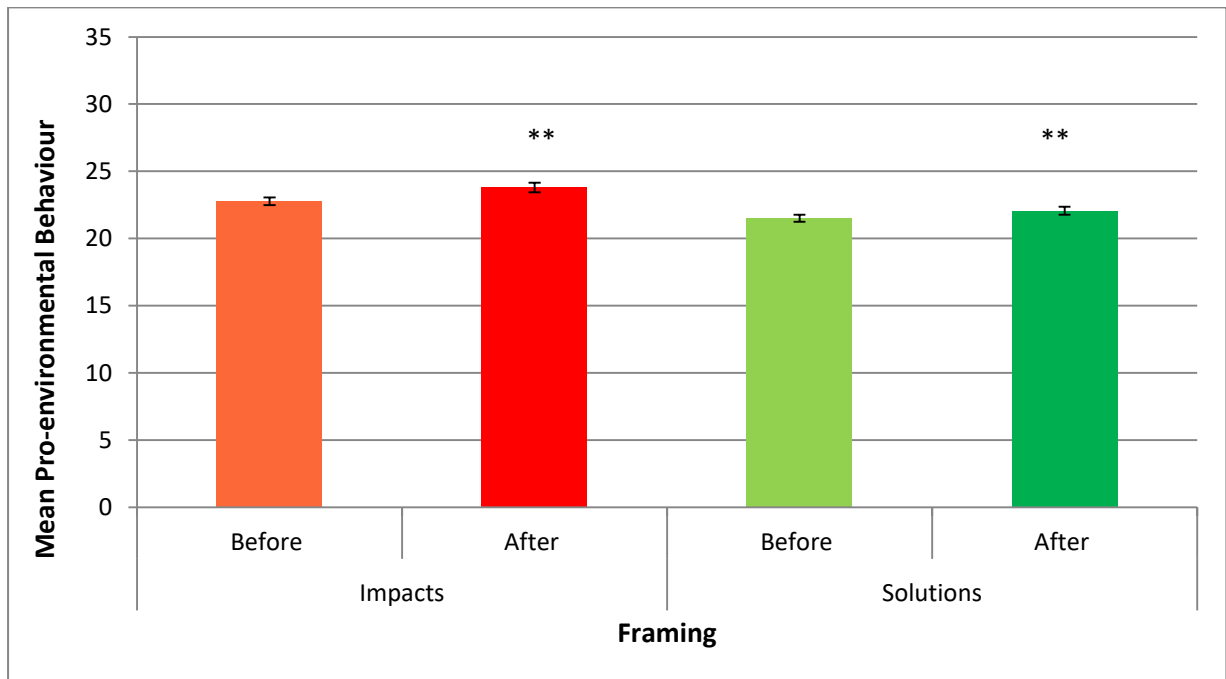
## 5.1 General Information

It is important that the reader can distinguish between graphs having the different y-axis of Mean Pro-environmental Behaviour, with a range from 0-35 (e.g. Figure 15) and Mean Change In Pro-environmental Behaviour, with varying ranges (e.g. Figure 19). Pro-environmental results collected before and after framing are referred to as pre-framing and post-framing in the text. All data has been rounded to 3 significant figures. The following abbreviations are used for standard deviation (SD), standard error of the mean (SEM) and degrees of freedom (DF). All error bars used are for SEM and this is referred to as “mean  $\pm$  SEM”. Statistical tests carried out include the paired two-tail t-test and unpaired unequal variances t-test. Summaries have been provided at the end of each section, to help the reader to disseminate and understand the project’s results and main findings. Asterisks have been added to graphs to show where significant differences occur in the results and the different levels of the p-value. The scale used to represent the level of significance for this research project’s findings in graphs are as follows: 1 asterisk “\*” =  $p < 0.05$ , 2 asterisks “\*\*” =  $p < 0.01$ , 3 asterisks “\*\*\*” =  $p < 0.001$  and finally 4 asterisks “\*\*\*\*” =  $p < 0.0001$ .

## 5.2 Overall Framing Effect On Pro-environmental Behaviour

### 5.2.1 Students

The educational intervention resulted in significant increases in students’ pro-environmental behaviour, both with the impacts and the solutions framing (Figure 15). The two framings led to different degrees of an increase in pro-environmental behaviour. A greater mean increase in pro-environmental behaviour was caused by the impacts framing (+1.1) than for the solutions framing (+0.6). The differences in pro-environmental behaviour caused by the framings were both of significance of  $p < 0.01$ , with Impacts ( $p = 0.001$ ) and Solutions ( $p = 0.009$ ) (Table 6). The pre-framing pro-environmental behaviour results for impacts framing students were tested against pre-framing results for solutions students, with a significance of  $p = 0.0014$  ( $p < 0.01$ ). The impacts framing students had a slightly higher starting level of pro-environmental behaviour at 22.7, compared to the solutions framing students at 21.5.



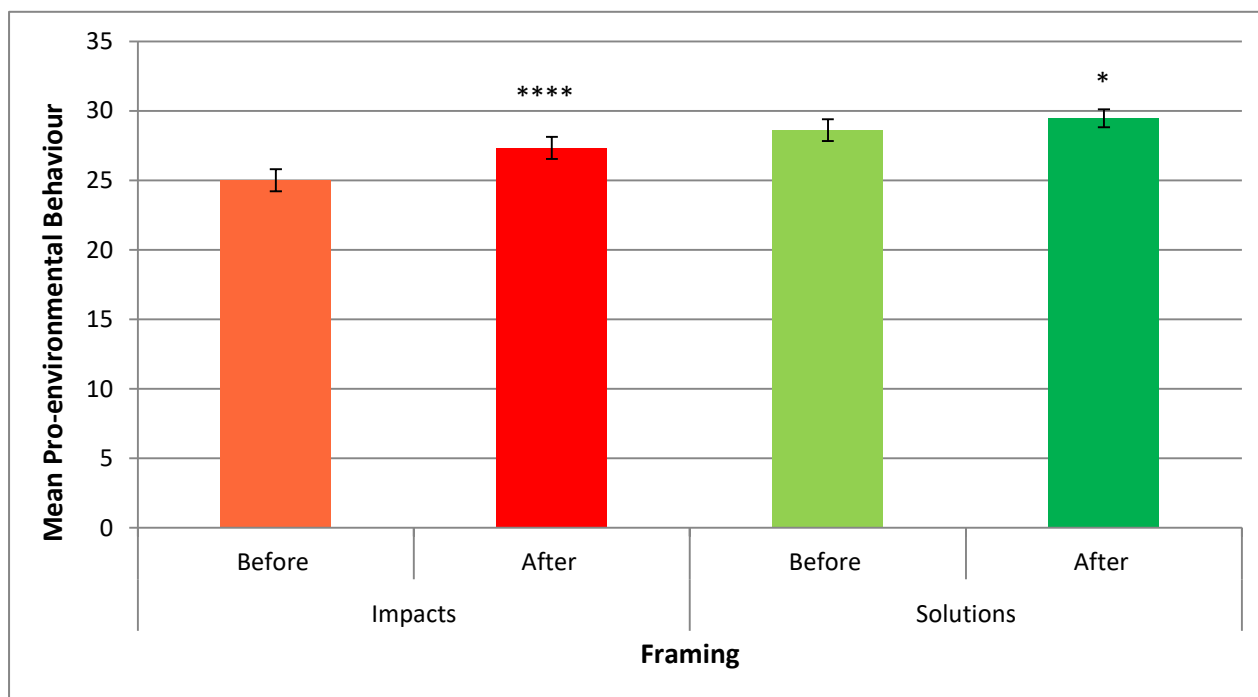
**Figure 15.** Pro-environmental behaviour (mean  $\pm$  SEM) for 10-17 year old students before and after a framing (Impacts and Solutions). Total of 604 students. Impacts = 270 students; Solutions = 334 students. Paired two-tailed t-test. Impacts = 269 df,  $p < 0.01$ ; Solutions = 333 df,  $p < 0.01$ .

	Impacts		Solutions	
	Before	After	Before	After
Sample Number	270	270	334	334
Mean Pro-environmental Behaviour	22.7	23.8	21.5	22.1
SD	4.71	5.88	4.86	5.40
SEM	0.28	0.35	0.26	0.29
P-value		0.0010		0.009

**Table 6.** Data for students' mean pro-environmental behaviour before and after a framing (Impacts and Solutions).

## 5.2.2 Teachers

The educational intervention resulted in significant increases in teachers' pro-environmental behaviour, both with the impacts framing and the solutions framing (Figure 16). The two framings led to different degrees of an increase in pro-environmental behaviour. A greater mean increase in pro-environmental behaviour was caused by the impacts framing (+2.3) than for the solutions framing (+0.8). The differences in pro-environmental behaviour caused by the framings were of significance of  $p < 0.0001$  for impacts ( $p = 0.00002$ ) and  $p < 0.05$  for solutions ( $p = 0.042$ ) (Table 7). The pre-framing pro-environmental behaviour results for impact framing teachers were tested against pre-framing results for solutions framing teachers, with significance found at  $p = 0.0018$  ( $p < 0.01$ ). The impacts framing teachers had a lower pre-framing level of pro-environmental behaviour at 25, compared to the solutions framing teachers at 28.6.



**Figure 16.** Pro-environmental behaviour (mean  $\pm$  SEM) for teachers before and after a framing (Impacts and Solutions). Total of 71 teachers. Impacts = 43 teachers; Solutions = 28 teachers. Paired two-tail t-test. Impacts = 42 df,  $p < 0.0001$ ; Solutions = 27 df,  $p < 0.05$ .

	Impacts		Solutions	
	Before	After	Before	After
No. of students	43	43	28	28
Mean Pro-environmental Behaviour	25	27.3	28.6	29.4
SD	5.2	5.19	4.1	3.44
SE	0.79	0.79	0.77	0.65
P-value		0.00002		0.042

**Table 7.** Data for teachers' mean pro-environmental behaviour before and after a framing (Impacts and Solutions).

### 5.2.3 Summary: Overall Framing Effect

- For students and teachers, the impacts and the solutions framing both led to significant increases in pro-environmental behaviour.
- For students and teachers, the impacts framing led to a greater increase in pro-environmental behaviour than solutions.
- For students, the impacts framing had a higher starting level of pre-framing pro-environmental behaviour (+1.2) than solutions.
- For teachers, the impacts framing had a lower starting level of pre-framing pro-environmental behaviour (-3.6) than solutions.
- Both teacher framings had higher pre-framing pro-environmental behaviour levels than either of the student pre-framing levels.

## 5.3 Framing Effect On Feelings

### 5.3.1 General Information

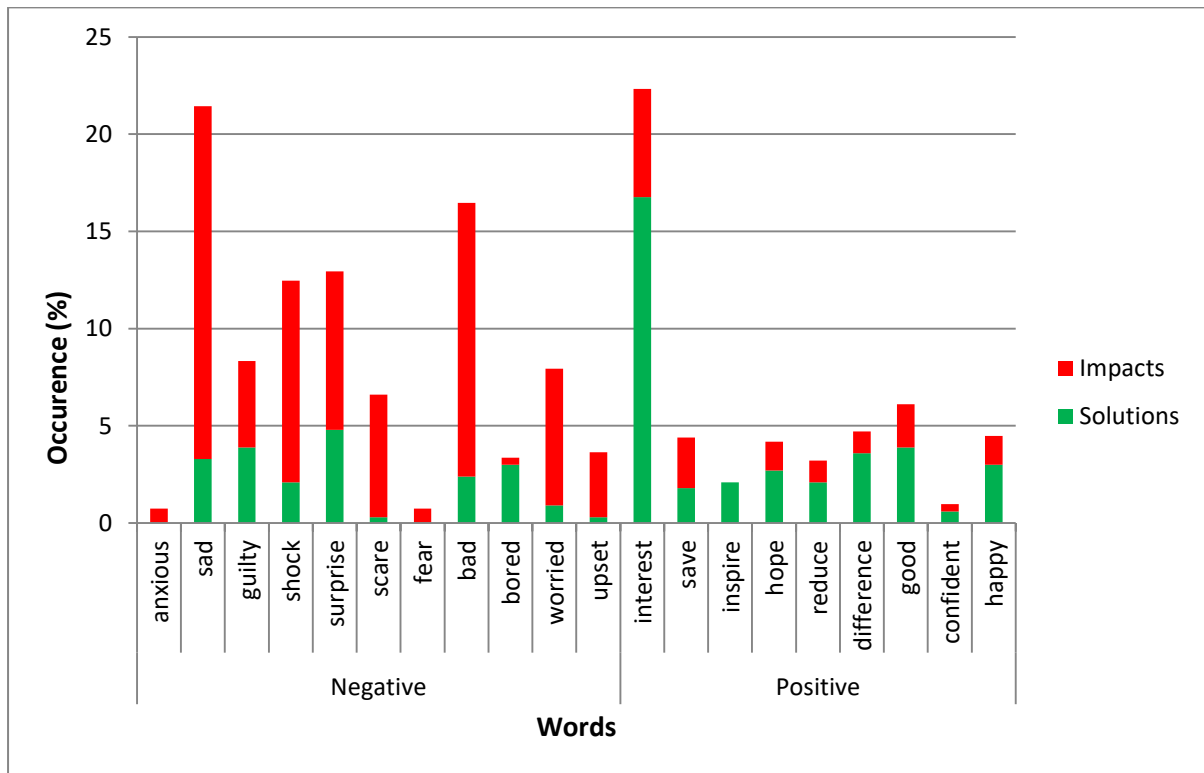
As described in the Method Section 3.3.8, students and teachers were asked an open question in Part Two (Box Two) of the survey straight after they had been given a framing presentation. The question asked was, *how did you feel during this part of the presentation?* At first, all words expressing feelings used by students were tallied, with the most frequent ones that occurred being identified. This resulted in a list of eleven positive and nine negative words, which were all used by more than 0.37% of students. These same words were then applied to the results collected from teachers, which allowed for a comparison to be carried out between students and teachers.

### 5.3.2 Students

Negatively orientated words such as *sad*, *shock* and *bad* were found to be more commonly used after the impacts framing to describe student's feelings (Figure 17). *Sad* was the most commonly used negative word, occurring 60 times and was written by 21% of students across both framings, split into impacts (18%) and solutions (3%). This is compared to positively orientated words, such as *happy* and *good*, which were more commonly used after the solutions framing. *Good* was the most commonly used positive word, occurring 19 times and was written by 6% of students across both framings, split into impacts (2%) and solutions (4%). The most commonly used word to describe feelings was *interest*, which occurred 71 times and was written by 22% of students across both framings, split into impacts (5%) and solutions (17%).

A greater number of negatively orientated words in total (269) were written to describe feelings, split into impacts (199) and solutions (70). Positively orientated words (including *interest*) were found 155 times in total, split into impacts (43 times) and solutions (112). This trend was found, even though the solutions framing was presented to 64 more students than had an impacts framing (270:334). However, it should be noted that there were two more negatively orientated words searched for, than positively orientated.





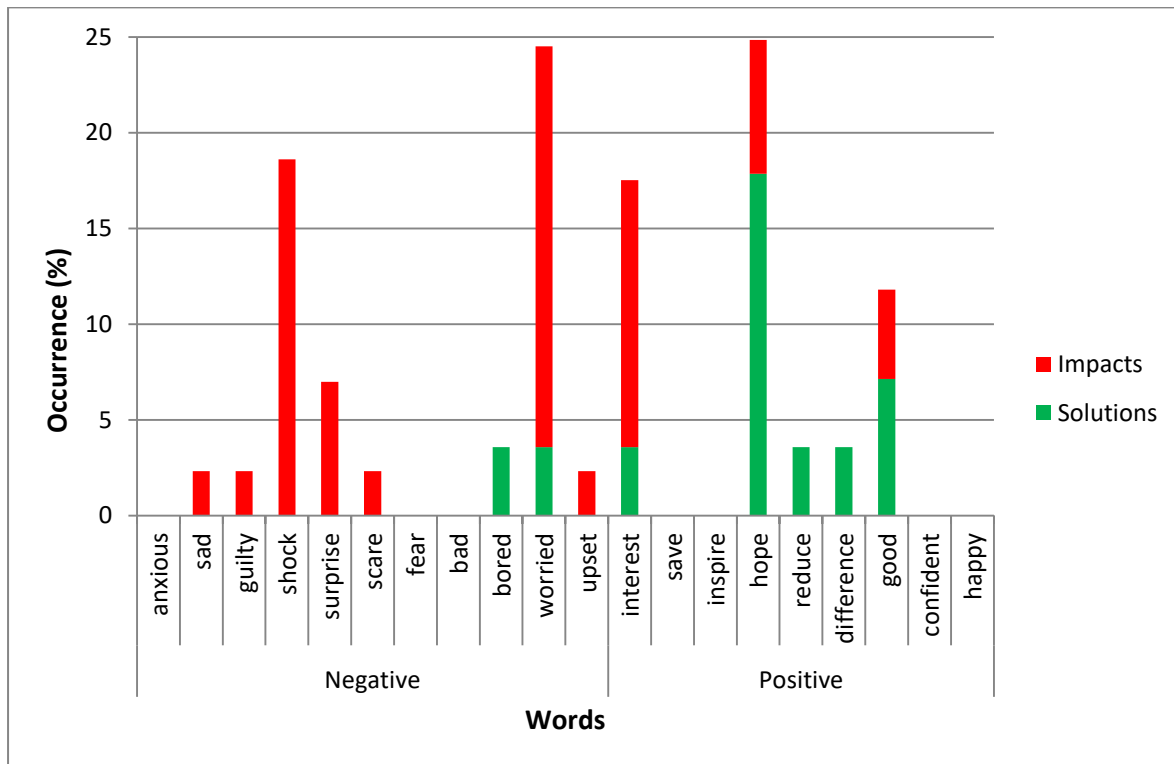
**Figure 17.** The occurrence of words used by students after a framing (impacts and solutions) aged between 10-17 in answer to the question of how did you feel during this part of the presentation? Total = 604 students. Impacts = 270 students; Solutions = 334 students. (See Table A18 in Appendix for Results Table).

### 5.3.3 Teachers

Negatively orientated words such as *shock* and *worried*, were found to be more frequently used after the impacts framing by teachers (Figure 18). *Worried* was the most commonly used negatively orientated word, occurring 10 times and was written by 19% of teachers across both framings, split into impacts (19%) and solutions (0%). This is compared to positively orientated words, such as *hope* and *good*, which were more commonly used after the solutions presentation. *Hope* was the most commonly used positively orientated word, occurring 8 times and was written by 25% of teachers across both framings, split into impacts (7%) and solutions (18%).

With teachers, *interest* was not the most commonly used word overall to describe feelings. It was however still one of the most commonly used words, which occurred 7 times and was written by 17% of teachers across both framings, split into impacts (14%) and solutions (3%).

A similar number of negative and positive words were written by teachers to describe feelings. The eleven negative words (total 26) were split into impacts (24) and solutions (2). The nine positive words (total 21) (including *interest*) were split into impacts (11) and solutions (10).



**Figure 18.** The occurrence of words used by teachers after a framing (impacts and solutions) in answer to the question of how did you feel during this part of the presentation? Total = 71 teachers. Impacts = 43 teachers; Solutions = 28 teachers. (See Table A19 in Appendix for Results Table).

### 5.3.4 Summary: Overall Framing Effect On Feelings

- Negatively orientated words were more frequently used after the impacts framing and positively orientated words were more frequently used after the solutions framing.
- For students, the positively orientated word *interest* was written more frequently after the solutions framing, than an impacts framing. The opposite trend was found for teachers.

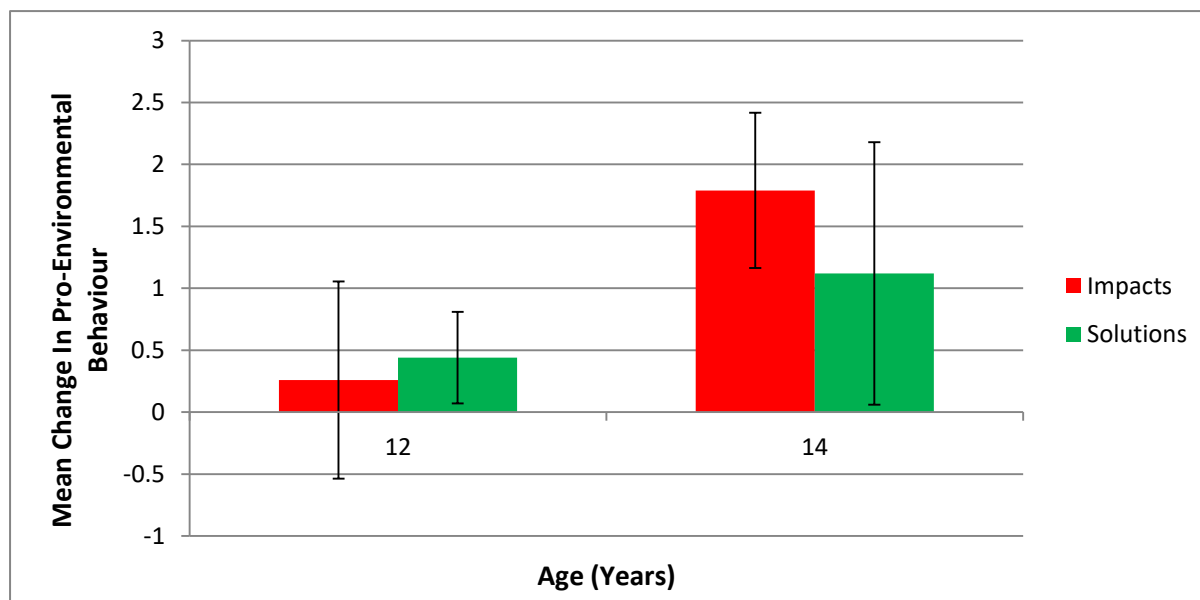
## 5.4 Students Age And The Framing Effect

Due to the large numbers of students that participated in data collection and that in each framing there were equally large sample sizes (270:334), it was decided to investigate further into the framing effect on students using certain variables. Age was chosen first, due to the large age-range of 10-17 in student participants. As the majority of students were aged between 11-14, this age-range was also analysed separately. No significant effect was found within this age-range for student's age and framing on their pro-environmental behaviour (See Figure A30 and Table A20 in Appendix for the graph and Results Table).

### 5.4.1 Age: Twelve Year Olds And Fourteen Year Olds

A total of 203 12 year olds students participated in the study, split into impacts (58) and solutions (145). 14 year old students were a total of 66, split into impacts (58) and solutions (8). There was no significant difference on pro-environmental behaviour for either an impacts or a solutions framing

for 12 year olds. An impacts framing had a significant difference on the change in pro-environmental behaviour for 14 year olds ( $p=0.0059$ ,  $p<0.01$ ). A solutions framing had no significant difference. Both impacts and solutions framing had a greater increase on the change in pro-environmental behaviour of 14 year olds, compared to 12 year olds (Figure 19; Table 8). When 12 year olds who had an impacts framing change were compared with 14 year olds who had an impacts framing, no significant difference was found. This was also found between the two age groups with a solutions framing. But when both framings carried out to 12 year olds were combined and compared with both framings carried out to 14 year olds, a significant difference was found ( $P=0.048$ ,  $p<0.05$ ).



**Figure 19.** The mean change in pro-environmental behaviour (mean  $\pm$  SEM) for students aged 12 and 14 years old after a framing (impacts and solutions). 12 year olds: Impacts = 58 students; Solutions = 145 students. Unpaired two-tail t-test assuming unequal variances. Impacts= 57 df,  $p=0.75$ ; Solutions=144 df,  $p=0.24$ . 14 year olds: Impacts=58 students; Solutions = 8 students. Unpaired two-tail t-test assuming unequal variances. Impacts = 57 df,  $p=0.0059$ ; Solutions=7 df,  $p=0.32$ .

Age (years)	Impacts					Solutions				
	Before	After	Mean Change	SD	SE	Before	After	Mean Change	SD	SE
12	22.96	23.22	0.26	6.06	0.79	21.17	21.6	0.43	4.46	0.37
14	23.20	25	1.8	4.77	0.62	19.88	21	1.12	2.99	1.05

**Table 8.** 12 and 14 year old students' mean change in pro-environmental behaviour before and after a framing (impacts and solutions).

#### 5.4.2 Summary: Age

- Impacts framing had a significant effect on the mean change in pro-environmental behaviour of 14 year olds.
- Combined framing results (impacts and solutions) had a significant effect between 12 and 14 year olds. To clarify, no students received both framings, but rather both sets of results for each framing were combined.

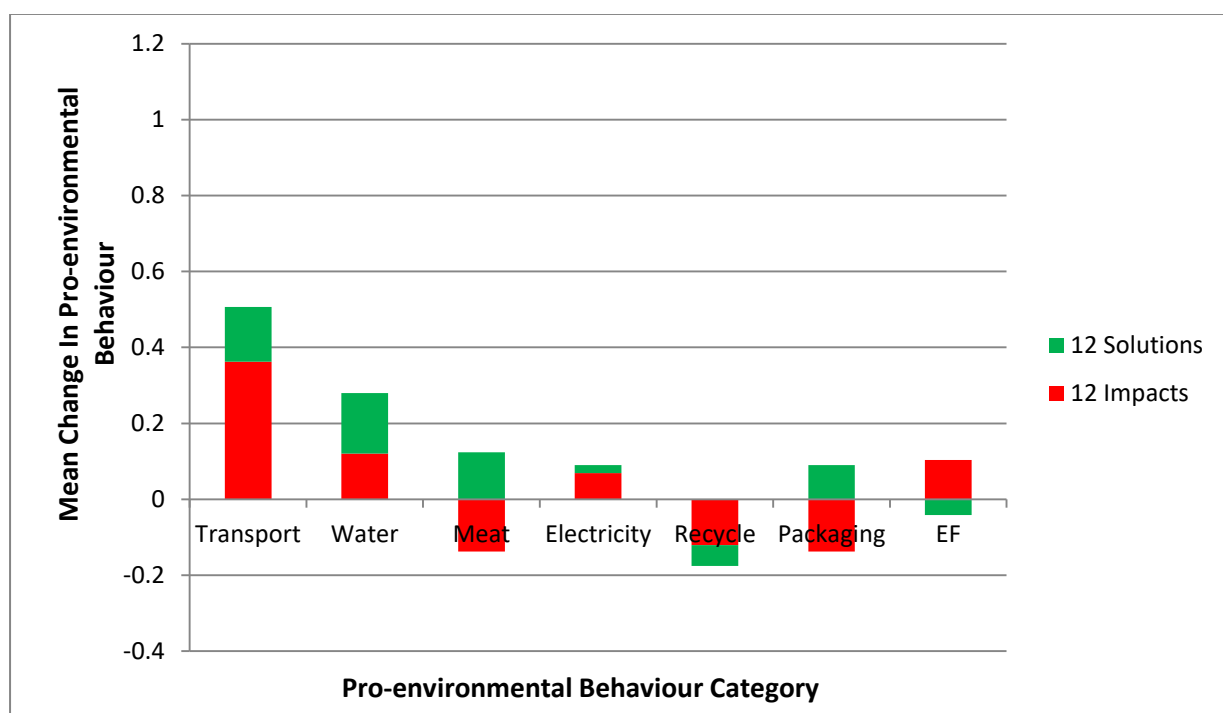
## 5.5 Mean Change In Each Pro-environmental Behaviour Category

### 5.5.1 General Information

Pro-environmental behaviour will now be analysed in greater detail, by using the seven categories associated with the questions asked in Survey Part One (pre-framing) and Part Three (post-framing). The categories were transport, water, meat, electricity, recycling, packaging and encouraging family and friends to act environmentally friendly. These questions are shown in Section 3.3.3.4 (Figure 7).

### 5.5.2 12 Year Olds

Transport had the greatest increase overall, with impacts leading to a larger increase in intended pro-environmental behaviour than solutions (Figure 20). The impacts framing led to a reduction in pro-environmental behaviour for 12 year old students in the categories of meat, recycling and packaging. The solutions framing led to a reduction in behaviour for 12 year old students in the categories of recycling and encouraging family and friends to act environmentally friendly (EF). These negatives are not shown in the overall pro-environmental behaviour change graph for 12 year olds (Figure 19).

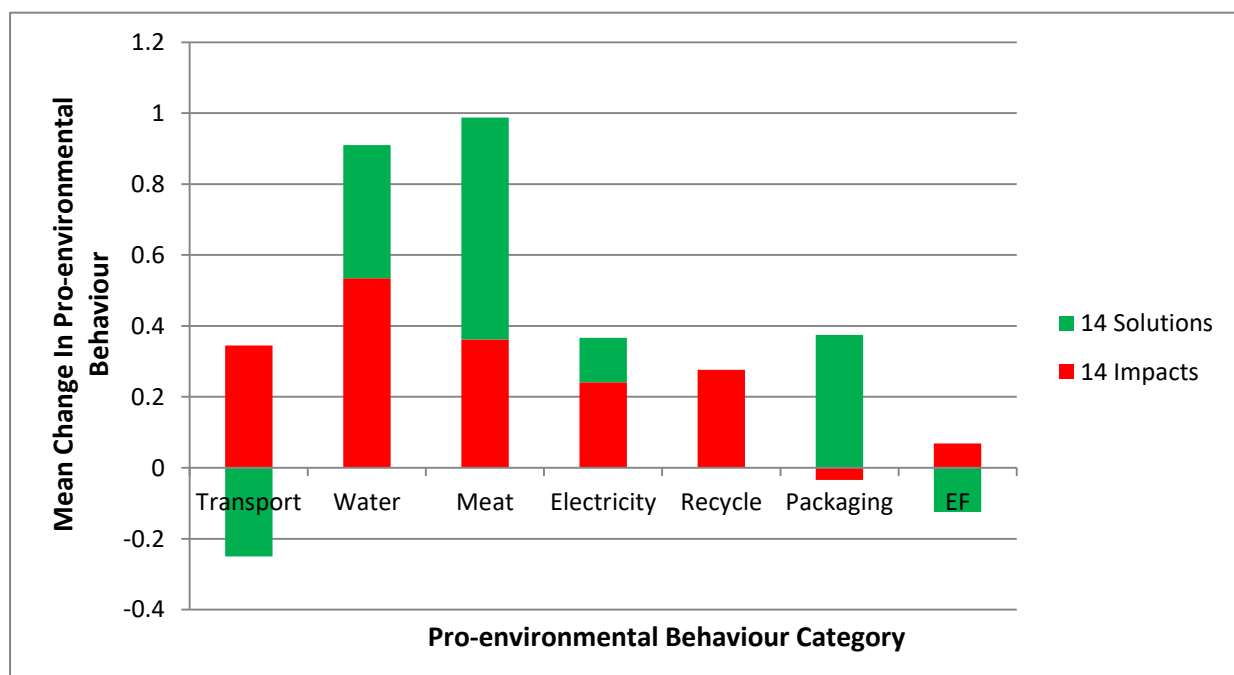


**Figure 20.** Mean change in pro-environmental behaviour in each category for 12 year old students under a framing (impacts and solutions). Total = 203 students. Impacts = 58 students; Solutions = 145 students. EF = to encourage friends and family to act environmentally friendly (See Table A21 in Appendix for Results Table).

### 5.5.3 14 Year Olds

Water and meat have the largest increases overall in intended pro-environmental behaviour, with an impacts framing causing a greater positive change for water, and a solutions framing causing a greater positive change for meat (Figure 21). An impacts framing has led to a mean reduction for 14

year old students in the categories of packaging. A solutions framing has led to a mean reduction for 14 year old students in the categories of transport and encouraging family and friends to act environmentally friendly (EF). As for 12 year olds, these negatives are not shown in the overall pro-environmental behaviour change graph (Figure 19).



**Figure 21.** Mean change in pro-environmental behaviour in each category for 14 year old students under a framing (impacts and solutions). Total = 66 students. Impacts = 58 students; Solutions = 8 students. EF = to encourage friends and family to act environmentally friendly. (See Table A22 in Appendix for results table).

#### 5.5.4 Summary: Pro-environmental Behaviour Categories

- Intention to buying products that have less packaging is reduced by an impacts framing for both 12 year olds and 14 year olds.
- Encouraging family and friends to act environmentally friendly (EF) has been reduced by a solutions framing for both 12 and 14 year olds students.
- Intention to recycle is reduced by a solutions framing for 12 year olds. No change for 14 year olds.
- Increase for both framings for both age-groups for pro-environmental behaviour towards electricity and water.

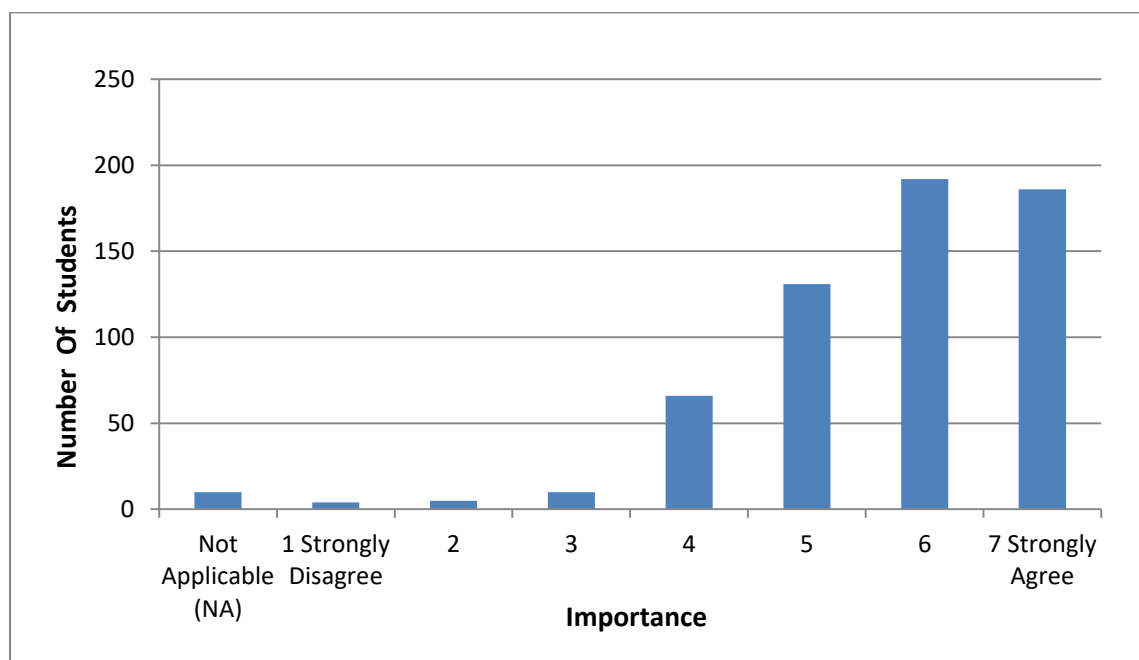
#### 5.5.5 Further Variables Required

The question was then asked if age was a meaningful variable to use to see how framing can affect the pro-environmental behaviour of students. It was decided that it was not, due to their potentially being many underlying variables at play capable of affecting the results. Age is so irregularly represented across the sample, with different numbers of students in each age group (Table 3), that it didn't seem reasonable to pursue the age and framing effect further. Thus, it was decided that further analysis was to be conducted on the following variables: climate change importance, climate change beliefs, gender and nationality/location.

## 5.6 Climate Change Importance Of Students

Students were categorised into either being *concerned* or *unconcerned* about climate change. Here, it may be useful for the reader to recall the statement presented to the participants: *Addressing climate change is today one of the most important issues facing society today*. A seven point Likert scale was used from one (strongly disagree) to seven (strongly agree).

Students categorised as being *concerned* about climate change answered between 5 to 7 (84.3%). *Unconcerned* students were those that answered between 1 to 4 (14.03%). Students who didn't answer the question were listed as Not Applicable (NA; 1.67%) (Figure 22).



**Figure 22.** Students' views on the importance of climate change (pre-framing) after reading the statement: *Addressing climate change is one of the most important issues facing society today*. NA = Not Applicable. Total = 604 students (See Table A23 in Appendix for Results Table).

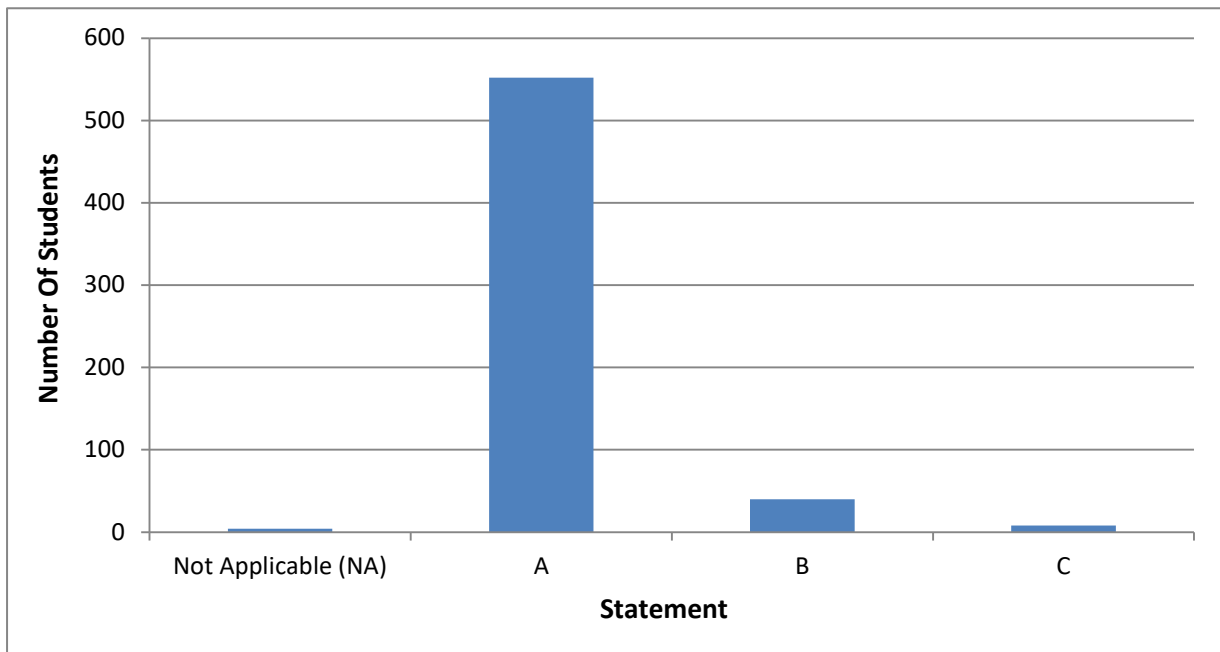
## 5.7 Student's Climate Change Beliefs And The Framing Effect

### 5.7.1 General Information

Students were categorised into being either *convinced* or *unconvinced* about climate change and its present day link to human activities. Here, it may be useful for the reader to recall the statements presented to the participants:

- A) I believe that climate change is occurring, and human activities are having significant effects on climate change
- B) I believe climate change is occurring, but human activities are not having significant effects on climate change
- C) I do not believe climate change is occurring

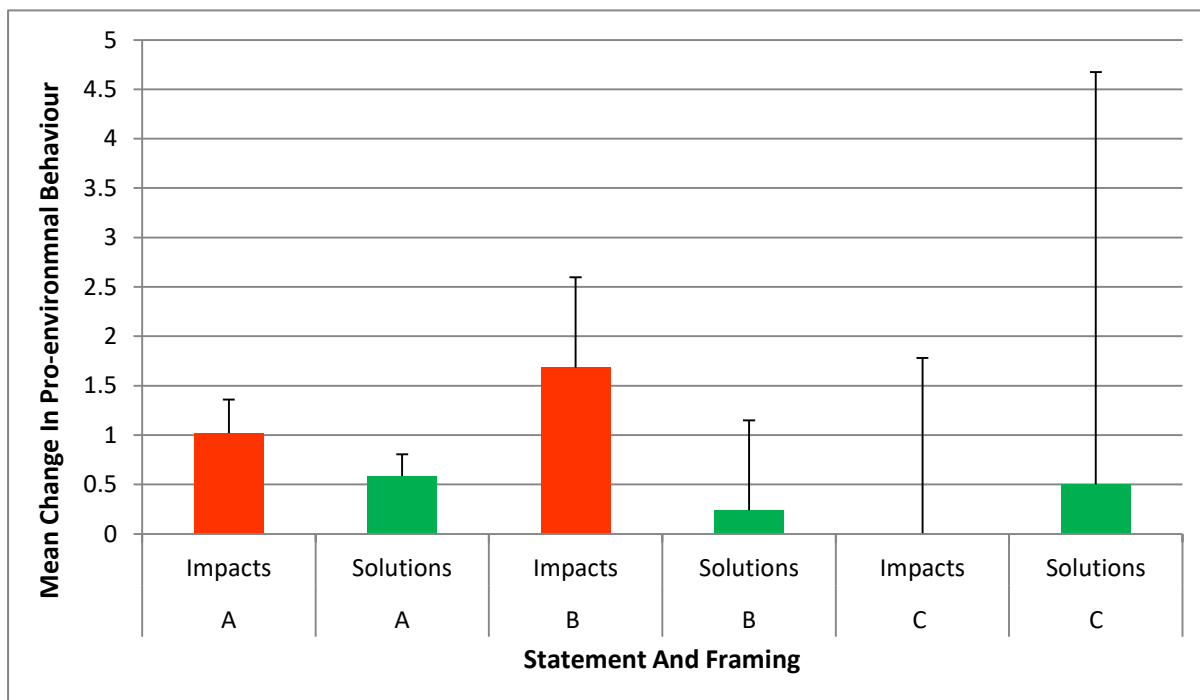
Students categorised as being *convinced* about climate change were those that answered Statement A (91.4%). *Unconvinced* students were those that answered Statements B or C (7.94%). Students who didn't answer the question were listed as Not Applicable (NA; 0.66%) (Figure 23).



**Figure 23.** Students' beliefs on climate change (pre-framing) by choosing either Statements A, B or C. NA = Not Applicable. Total = 604 students (See Table A24 in Appendix for Results Table)

### 5.7.2 Framing Effect on Pro-environmental Behaviour For Each Category

How the pro-environmental behaviour changed for each statement and each framing is shown in Figure 24 and Table 9. All the statements and framing combinations had an increase in pro-environmental behaviour post-framing, except for those that chose option C with a solutions framing. This had no average change at all. Students that chose statement B and had an impacts framing had the greatest increase in pro-environmental behaviour.



**Figure 24.** Mean change in pro-environmental behaviour (mean  $\pm$  SEM) for students for each climate change belief statement choice with a framing. Minus error bars were removed due to the large SEM for Solutions B, Impacts C and Solutions C, to prevent the graph from being distorted and having a negative X-axis.

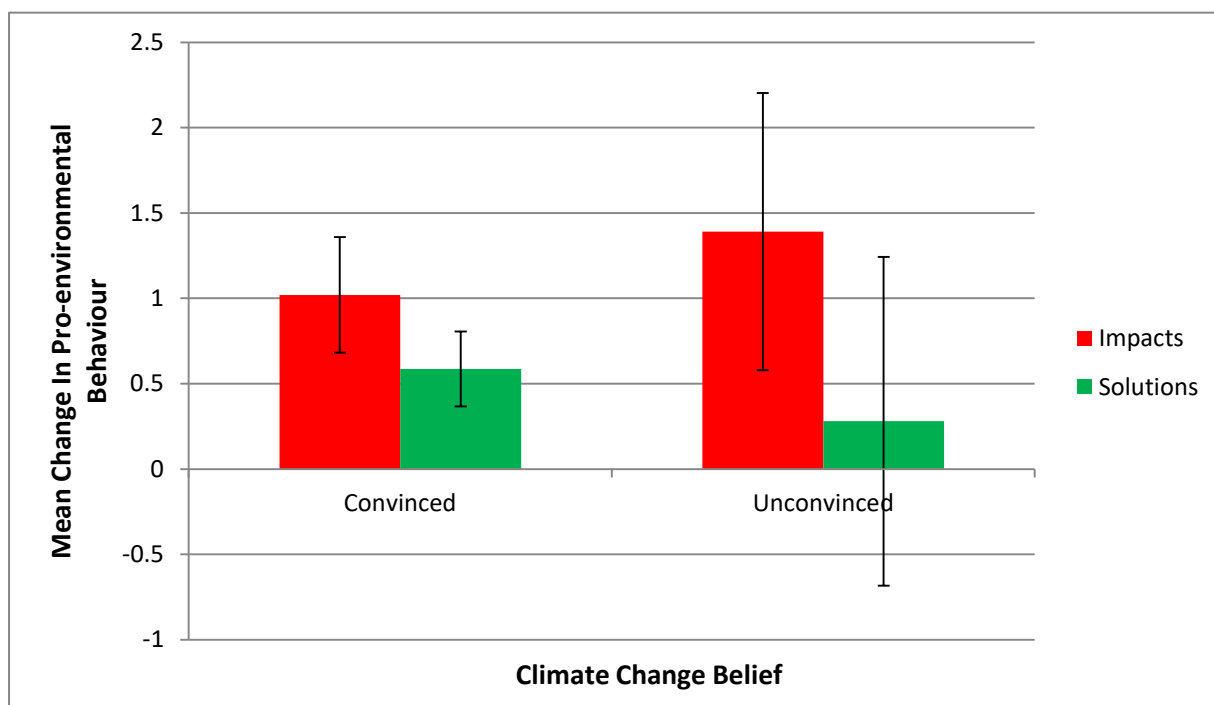
Statement	A		B		C	
Framing	Impacts	Solutions	Impacts	Solutions	Impacts	Solutions
Mean Change In Pro-environmental Behaviour	1.02	0.58	1.68	0.24	0	0.5
Student Number	245	307	19	21	4	4
SD	5.28	3.83	3.98	4.17	3.56	8.34
SEM	0.34	0.22	0.91	0.91	1.78	4.17

**Table 9.** Mean change in pro-environmental behaviour for students on their beliefs of climate change with a framing (impacts and solutions). Total = 604 students.



### 5.7.3 Convinced and Unconvinced Categories

The categories of *convinced* and *unconvinced* were now formed. Statement A formed the *convinced* category and Statements B and C were combined to form the *unconvinced* category (Figure 25; Table 10). When results for both framings are added together for each category, they have a similar mean increase in pro-environmental behaviour for *convinced* (1.6) and *unconvinced* (1.67) participants. However, care should be taken with this result as there was a large difference in the number of participants in each category (551:48). An impacts framing led to a greater increase for both *convinced* and *unconvinced* participants, with this being greater in the *unconvinced* category. No significance was found between each framing for each climate change belief, as well as no significance found between both beliefs for each framing.



**Figure 25.** Mean change in pro-environmental behaviour (mean  $\pm$  SEM) for students' convinced and unconvinced about climate change. Total = 599 students. Convinced = 551 students. Unconvinced = 48 students. 5 students did not answer the question (NA).

Climate Change Belief	Convinced		Unconvinced	
	Impacts	Solutions	Impacts	Solutions
Number	245	306	23	25
Mean Change In Pro-environmental Behaviour	1.02	0.59	1.39	0.28
SD	5.29	3.83	3.89	4.82
SE	0.34	0.22	0.81	0.96

**Table 10.** Mean change in pro-environmental behaviour for students' convinced and unconvinced about climate change. Total = 599 students. Convinced = 551 students, Unconvinced = 48 students. 5 students did not answer the question (NA).

## 5.8 Student's Gender And The Framing Effect

### 5.8.1 Social Demographics

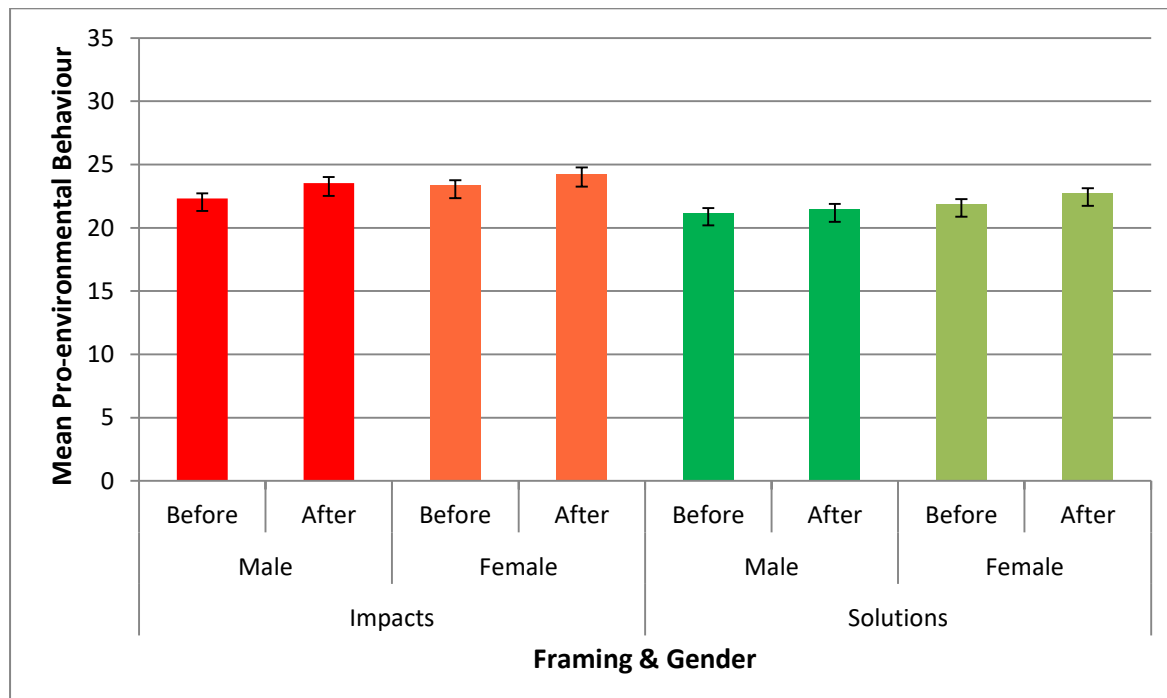
A greater number of males than females took part in each framing, but the distribution was still fairly equal as shown in Table 11.

	Impacts			Solutions			Total
	Male	Female	NA	Male	Female		
Number	141	128	1	181	152	1	604

**Table 11.** The number of males and female students in each framing. Impacts = 270 students, Solutions = 334 students. Total = 604 students. NA = Not Applicable.

Figure 26; Table 12 show the pro-environmental behaviour before and after a framing for each gender. This should be distinguished to Figure 27 and Table 13, which shows the mean change in pro-environmental behaviour for each gender and framing.

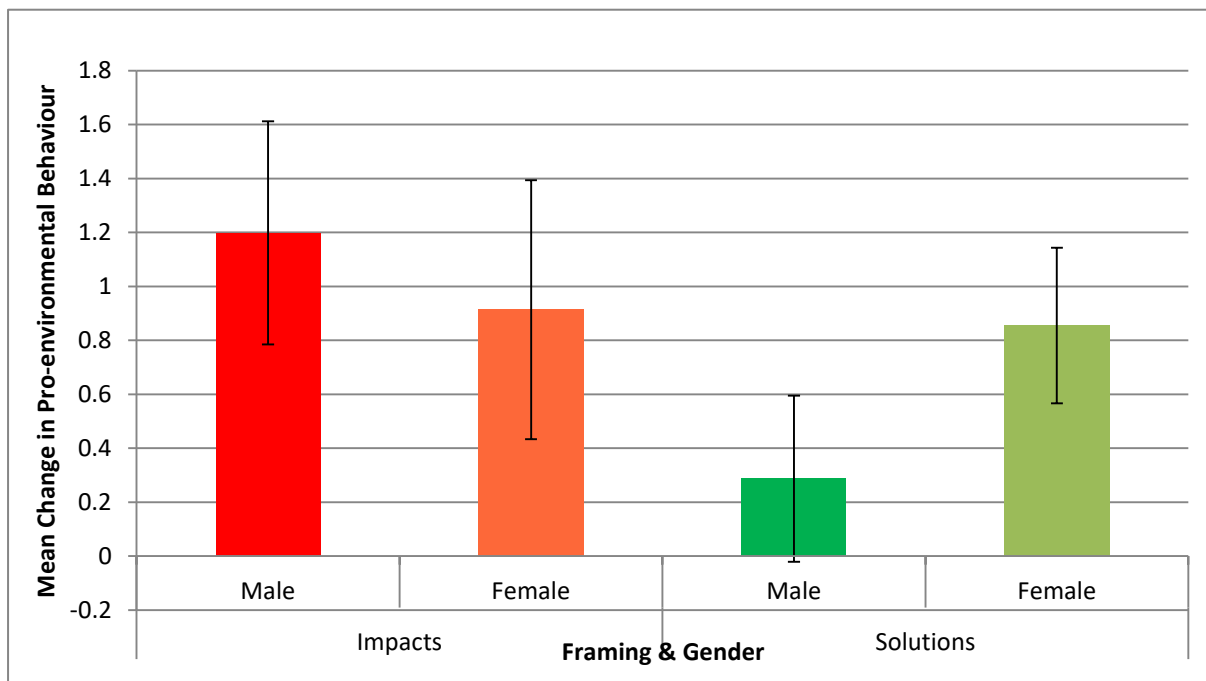
The largest change in pro-environmental behaviour was seen for males who had the impacts framing (+1.2). The smallest change was seen for males who had the solutions framing (+0.3). A very similar change was seen for females under framings, impacts (0.9) and females (0.8). No significance was seen for males or females for both framings. "Near significance" was seen for the mean change in pro-environmental behaviour for males under an impacts framing, against males under a solutions framing ( $p=0.07$ ).



**Figure 26.** Pro-environmental behaviour (mean  $\pm$  SEM) for male and female students before and after a framing (impacts and solutions). Impacts = 141 males, 128 females; Solutions = 181 males, 152 females. Unpaired two-tail t-test assuming unequal variances. Impacts Male = 268 df,  $p=0.055$ ; Impacts Female = 243 df,  $p=0.17$ ; Solutions Male = 355 df,  $p=0.61$ ; Solutions Female = 301 df,  $p=0.12$ .

Framing	Impacts				Solutions			
Gender	Male		Female		Male		Female	
	Before	After	Before	After	Before	After	Before	After
Mean Pro-environmental Behaviour	22.3	23.5	23.3	24.2	21.1	21.4	21.9	22.7
SD	4.62	5.76	4.67	5.83	5.07	5.72	4.59	4.93
SE	0.39	0.48	0.41	0.52	0.38	0.43	0.37	0.39
P-value		0.055		0.17		0.61		0.12

**Table 12.** Mean pro-environmental behaviour (mean  $\pm$  SEM) for male and female students before and after a framing (impacts and solutions).



**Figure 27.** Mean change in pro-environmental behaviour (mean  $\pm$  SEM) for male and female students before and after a framing (impacts and solutions).

Framing	Impacts	Impacts	Solutions	Solutions
Gender	Male	Female	Male	Female
Mean Change In Pro-environmental Behaviour	1.19	0.91	0.29	0.86
SD	4.91	5.43	4.15	3.55
SE	0.41	0.48	0.31	0.29

**Table 13.** Mean change in pro-environmental behaviour for male and female students under a framing (impacts and solutions).

## 5.9 Student's Nationality/Location And The Framing Effect

### 5.9.1 General Information

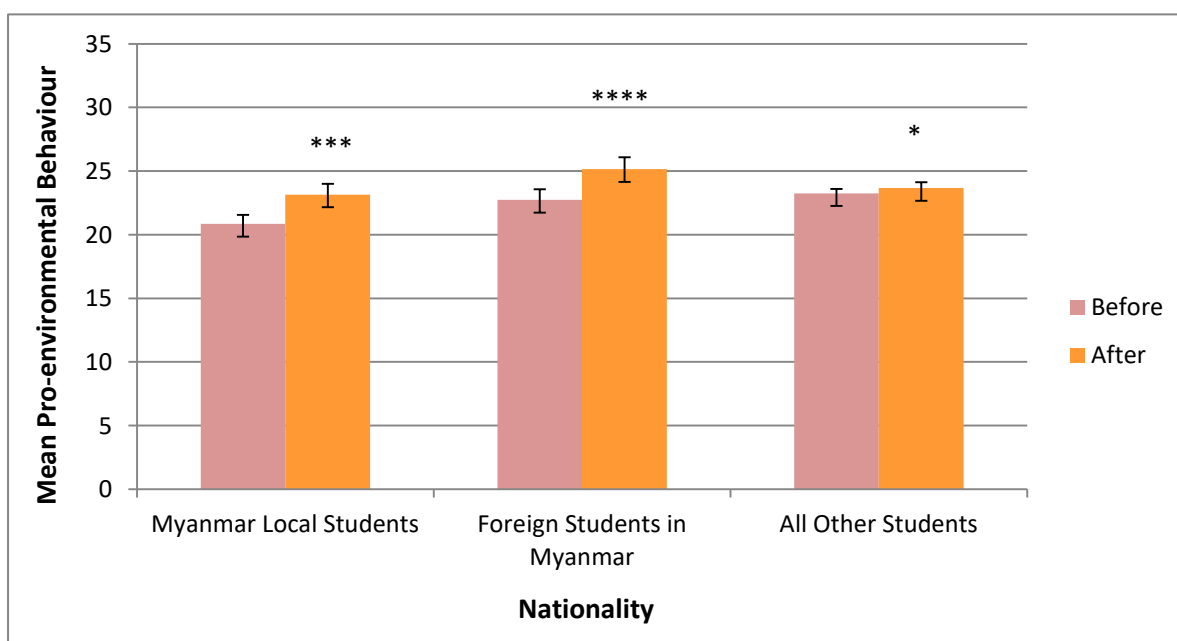
The effect that student's nationality & living location was having with regards to framing was analysed, focusing on an impacts framing as this led to the greatest change in pro-environmental behaviour. Students from two international schools in Myanmar were separated out into being either local (from Myanmar) or foreign (not from Myanmar, but at school in the country). All other students who had the impacts framing (majority from an international school in Singapore) were also included for a comparison.

Figure 28; Table 14 shows the pro-environmental behaviour before and after a framing for each nationality under each framing. This should be distinguished to Figure 29 and Table 15, which shows the mean change in pro-environmental behaviour for each nationality/location under each framing.

Pro-environmental behaviour changes for each of the seven categories can be found in Figure A31 and Table A25 in the Appendix, for the graph and Results Table. It was very difficult to find any trends in the results and this needs further time and research.

### 5.9.2 Pro-environmental Behaviour Before And After An Impacts Framing

A significant difference in pro-environmental behaviour before and after an impacts framing was found for Myanmar Local, Myanmar Foreign and All Other Students (Figure 28 and Table 14).



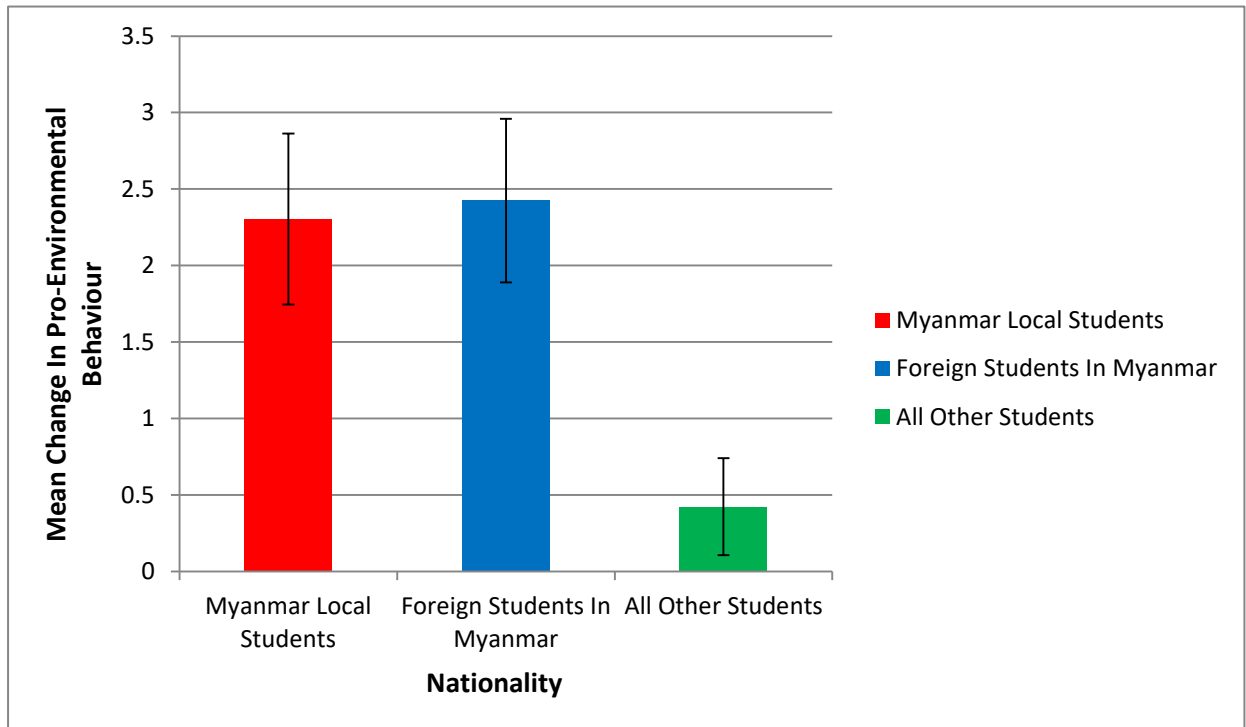
**Figure 28.** Pro-environmental behaviour (mean  $\pm$  SEM) for students located at two international schools in Myanmar who had the impacts framing (Myanmar local and foreign students in Myanmar). They are then compared to all other students who had the impacts framing (majority from a school in Singapore). Myanmar Local = 46 students, Foreign in Myanmar = 40 students, All Other = 184 students. Paired two-tail t-test. Myanmar Local = 45 df,  $p < 0.001$ ; Foreign in Myanmar = 39 df,  $p < 0.0001$ ; All Other = 343,  $p < 0.05$ .

Nationality	Before	SD	SE	After	Number	SD	SE	P-value
Myanmar Local Students	20.8	4.77	0.70	23.1	46	5.79	0.85	0.000157
Foreign Students in Myanmar	22.7	5.37	0.85	25.1	40	5.82	0.92	0.000053
All Other Students	23.2	4.73	0.35	23.6	184	6.17	0.45	0.46

**Table 14.** Data for students studying in Myanmar, split into local and foreign. All other students are also included. All had impacts framing. Local = 46 students, Foreign = 40 students, All Other = 184 students

### 5.9.3 Mean Change In Pro-environmental Behaviour

No significance was found when comparing the mean change in pro-environmental behaviour for Myanmar Local and Myanmar Foreign. Significance was found when comparing Myanmar Local to All Other Students ( $p = 0.004$ ;  $p < 0.01$ ) and also for Myanmar Foreign to All Other Students ( $p = 0.002$ ;  $p < 0.01$ ) (Figure 29).



**Figure 29.** Mean change in pro-environmental behaviour (mean  $\pm$  SEM) for Myanmar Local Students, Foreign Students in Myanmar and All Other Students, all who had the impacts framing. Local = 46 students, Foreign = 40 students, All Other = 184 students.

Nationality	Mean Change In Pro-environmental Behaviour	SD	SE
Myanmar Local Students	2.3	3.79	0.56
Foreign Students In Myanmar	2.4	3.38	0.53
All Other Students	0.4	4.31	0.32

**Table 15.** Data for Myanmar Local Students, Foreign Students in Myanmar and All Other Students who had the impacts framing. Local = 46 students, Foreign = 40 students, All Other = 184 students.

## 5.10 Climate Change Knowledge

### 5.10.1 Students

Straight after the Basic Climate Science presentation, participants were asked the question of: *what have you learnt? Is there anything that you didn't understand?* (as explained in Section 3.3.6, Part Two (Box One)). 30.6% of students' wrote the phrase "97%", which was linked to the knowledge learnt about 97% of climate scientists agreeing that climate change is primarily being caused by humans. Students were asked as part of the background information questions: *what do you use to learn and read about environmental issues?* (Section 3.3.9, Part Three, Question 5). The highest results were social media (47.2%) and TV (44.7%).

### 5.10.2 Teachers

Participants were asked the same question as for students, with 25.4% of teachers writing the phrase "97%", which was slightly less than students. The results from question 5 in the background information as same for students were TV (49%) and magazines (39%) as the highest sources.

## 5.11 Interviews

Some students were very nervous, unresponsive and gave short answers. The majority of students had good English, but the occasional student struggled in their communication. After a few minutes, most students got into a good flow and in every interview a good discussion was created. Six interviews were carried out in total, in six schools located in Singapore, Myanmar, Malaysia and Brunei (Table 16). All interviews were carried out to students, with none to teachers due to time restraint and scheduling difficulties. See A3.1-A3.6 in the Appendix for fully transcribed interviews. Some results from these interviews will be used in the discussion.

Interview Number	Country	Framing	Age-range	Total Number Of students	Male	Female
1	Singapore	Impacts	11-13 years old	7	4	3
2	Myanmar	Impacts	10-12 years old	4	2	2
3	Myanmar	Impacts	12-13 years old	4	0	4
4	Myanmar	Impacts	11-16 years old	6	3	3
5	Malaysia	Solutions	11-12 years old	5	2	3
6	Brunei	Solutions	11-12 years old	6	3	3

**Table 16.** *The six interviews carried out in Singapore, Myanmar, Malaysia and Brunei. (Four impacts and two solutions). Total of 32 students: 14 males and 18 females.*

# 6.0 DISCUSSION

## 6.1 Summary For Readers

Table 17 will be useful for readers to refer back to during the Discussion section.

Framing	Impacts	Solutions
Theory	Loss	Gain
Risk Behaviour	Risk-taking	Risk-averse
Pro-environmental Behaviour Results	Increase	Increase
Fear level	High	Low

**Table 17.** Summary of aspects of the present study to help the reader breakdown the discussion.

## 6.2 Overall Framing Effect on Students' & Teachers' Pro-Environmental Behaviour

Overall, both interventions led to significant improvements in pro-environmental behaviour. This is unusual, as environmental interventions based on the short-term have been shown in the past to be poor at encouraging people to act more environmentally friendly (Riede, Keller and Greissing, 2016).

This study had the hypothesis that an impacts framing of climate change causes a reduced level of pro-environmental behaviour, while a solutions orientated framing causes an increased level of pro-environmental behaviour. The results found led to the rejection of the hypothesis, due to both an impacts and a solutions framing leading to a significant increase in pro-environmental behaviour for students and teachers. The overall result for students and teachers suggests that an impacts framing of climate change is a more successful way than solutions, to influence people's mitigating behaviour. Tversky and Kahneman (1981) found that a loss frame leads to risk-taking behaviour and a gain frame leads to risk-averse behaviour. By taking the two assumptions that an impacts framing is a loss frame and that increasing your pro-environmental behaviour is an example of risk-averse behaviour, this particular result goes against what the theory would predict. However by assuming that a solutions framing is a gain frame, this also led to risk-averse behaviour and so does follow the result predicted by the theory.

### 6.2.1 Students

As described in the Results section, there was a significant difference in pro-environmental behaviour results collected before interventions took place (pre-framing), between students who had the impacts and solutions framing. This was not expected, but potential reasons for this will now be discussed. All students were of a similar age-range in both framings and all went to international schools in south-east Asia, but the country locations were different. The impacts framing sessions took place in Singapore and Myanmar, while the solutions framing took place in Malaysia and

Brunei. As well as location differences, other variables potentially affecting results were explored and will be discussed below, including age, gender, climate change beliefs and nationality.

One variable that could have influenced the difference in willingness to carry out pro-environmental behaviour between students in the two framings is their entering level of willingness, i.e. how willing they were to behave in a pro-environmental way prior to the programme. Students who had the impacts framing had a higher starting pre-framing pro-environmental behaviour than the students who had the solutions framing, but they still had a greater increase after the framing. Due to an impacts framing leading to a larger increase in pro-environmental behaviour than solutions framing, this shows that overall for students, a higher pre-framing level didn't necessarily mean a smaller increase post-framing. It could be assumed though that students with a higher pre-framing level of pro-environmental behaviour would already have greater knowledge and awareness on climate change, so would be less influenced by the Basic Climate Science and impacts framing presentations.

## **6.2.2 Teachers**

As described in the Results section and similar to students, there was a significant difference in pro-environmental behaviour results collected before interventions took place, between teachers who had the impacts and solutions framing. This was to be expected, due to the very different locations and circumstances where these two framing sessions occurred. The impacts framing teachers had a much lower pre-framing pro-environmental behaviour than the solutions framing teachers. This could also explain why an impacts framing had a much greater increase in teacher's pro-environmental behaviour, as they had a lower starting level and so had more amounts of knowledge and awareness to be gained (as discussed in Section 6.2.1). The impacts framing was carried out in an international school in Myanmar to every adult that worked there. The session was compulsory to attend and titled as "staff training", with the audience including teachers, assistants and maintenance workers. 63% of the audience were from the UK, 26% from other western countries and 11% from Myanmar. The solutions framing was carried out at an East Asia Regional Council of Schools (EARCOS) teacher's conference in Malaysian Borneo, with an audience that consisted of teachers who had actively chosen to attend the session, perhaps showing that they already had an interest in the topic. At the same time of the session taking place, there were twelve other educational sessions ongoing that teachers could have chosen to attend instead. 79% of the audience was from the USA or Canada, with the other 21% from various other countries worldwide.

Both teacher groups in each framing had a higher pre-framing pro-environmental behaviour results than the students. This was not a surprise as through training, teachers are expected to know about climate change.

## **6.3 Fear Appeals**

### **6.3.1 Pro-environmental Behaviour**

If the assumption is made that the impacts framing is an example of *fear appeals*, the results of the present study are in alignment with other studies showing that *fear appeals* can change people's behaviour positively towards mitigation (such as Cismaru *et al.*, 2011). Studies also suggest that *fear appeals* is effective at increasing awareness towards climate change (O'Neill and Nicholson-Cole, 2009) and at attracting attention to the subject (as written in Section 2.5). It must now be decided



whether this present study's results have shown this. Masud *et al.*, (2015) found that increased awareness and knowledge of climate change can influence people's attitudes to be of a more positive nature towards taking action. This has been shown in this study's result of students and teachers both have an increased pro-environmental behaviour under an impacts and solutions framing.

### 6.3.2 Personal Engagement

There is a big difference between changing behaviour and promoting personal engagement. Previous studies suggest that *fear appeals* can be a poor method to promote "personal engagement" (O'Neil and Nicholson-Cole, 2009, p355) and so it must be seen if this is also the case in this research project. An example of this could be to look at words used by students and teachers to describe feelings, and compare them after an impacts and solutions framing. The word *interest* was far more commonly used by students after a solutions framing. This perhaps agrees with the statement above, that an impacts framing (and so *fear appeals*), was a poor way to promote personal engagement in pro-environmental behaviour. It would be thought that if more interest is shown towards a topic, then a person would be more likely to become engaged after the frame messages and increase their pro-environmental behaviour. However, the reader must be aware that the word *interest* was only used by 22% of students overall (roughly 135 out of 604 students). The opposite result was found for teachers, with the word *interest* being used more frequently after an impacts framing. With both students and teachers using negative words more frequently after an impacts framing than after a solutions framing, perhaps this shows that an impacts framing stimulated more emotion and created a higher level of concern on climate change. This reaction may have increased the desire of a participant to try to make a difference, shown in that an impacts framing led to a higher increase in pro-environmental behaviour. O'Neil and Nicholson-Cole (2009) state that an image that doesn't threaten audiences and which link to everyday emotions can be most engaging. The images used in the impacts framing, such as a drowning planet (slide 13a) could lead to a feeling of threat to a participant. Images such as renewable energy (slide 15b) would not threaten an individual, apparently leading to them feeling more engaged. However, it is confusing that although a participant may have been less engaged after an impacts framing (and perhaps this wasn't the case for students due to the use of the word *interest*), this still caused both students and teachers to increase their pro-environmental behaviour by a greater amount, than after a solutions framing. Below is a comment by a student at an international school in Brunei, who was part of an interview session after having a solutions framing. Their answer shows a level of interest and engagement in the topic of climate change:

*Student: I think I want to learn more after hearing the solutions. I feel like we as a school can help and try to solve (the problems)*

### 6.3.3 Fear Appeals And Self-Efficacy

Research has shown that *self-efficacy* can have an effect on *fear-appeals* messages. *Self-efficacy* is a person's belief in their own ability to carry out an action that has been advised. This can also be compared to *collective efficacy*, which is the joint belief that a group has in their ability to solve an issue (Scharks, 2016). *Fear-appeals* messages only truly work when efficacy messages are included with them (Witte and Allen, 2000). This has been shown to be the case in advertising, with having a positive reaction to *fear appeals* information linked to a higher level of *self-efficacy* (Manyiwa and

Brennan, 2012). Chen (2016) found that views on *collective efficacy* affected the level of pro-environmental behaviour carried out under high-fear *appeal* messages. *Fear appeals* research shows that a higher *self-efficacy* affects views on attitude, behaviour and intention all in the same way, but there is still some uncertainty as to how useful this result is to changing pro-environmental behaviour (Scharks, 2016). Bandura (2000) suggested that due to climate change being a collective issue, *collective efficacy* would be even more effective at changing behaviour. Below is an example of a student living in Brunei, inferring their own *self efficacy*:

Presenter: *And is there anything that you think you can do individually now, not right now, but I mean in the next couple of weeks, in the next couple of months? Anything that you think you can do? Anything you have thought about which we spoke about or anything at all that could make a small difference?*

Student: *You could like warn family and friends and people can inform more people and eventually it'll like spread across the world and people can do things*

O'Neill *et al.*, (2013) found that images related to the impacts of climate change can negatively affect *self-efficacy*, but can increase the importance felt towards the topic. Images related to future energy positively affected *self-efficacy*, with images of politicians and celebrities negatively affecting the importance felt towards the topic and also *self-efficacy*. These results suggest that the use of images play an important role in improving people's views on the importance of climate change, and also their *self-efficacy*. However, images are thought to unlikely be able to positively affect importance of climate change and self-efficacy both at the same time (O'Neill *et al.*, 2013). Images can also give climate change "greater personal meaning" to people (Spence and Pidgeon, 2010, p6).

### **6.3.4 Using Fear Appeals Theory To Help Interpret Results**

#### **6.3.4.1 Drive Theory**

As discussed in Section 2.3.1, Drive theory is associated with an inverted U-shape response to different levels of fear. The theory states that high and low levels of fear cause people to have a lower intention to change behaviour. However, a medium level of fear can cause people to have a higher intention to change behaviour. The assumptions will now be made that an impacts framing prompted a high level of fear and a solutions framing prompted a low level of fear. Perhaps by combining an impacts and solutions framing, a medium level of fear would be created, which would lead to an even greater increase in pro-environmental behaviour. The addition of solutions would potentially reduce some of the fear and defensive responses caused from an impacts framing. Janis and Feshbach (1953) found that a medium level of fear would be communicated most successfully by using many facts and a moderate style of presentation. However, it is difficult to judge what is a high, medium and low intention to change behaviour with regards to this research project.

Many of the interviewed students stated that a combination of impacts and solutions framings would be the best form of communicating climate change, with regards to increasing pro-environmental behaviour. This would seem to agree with Drive theory, assuming that these framing combinations would cause a medium level of fear. This will be discussed further in Section 6.4.

#### **6.3.4.2 Protection Motivation Theory**

As discussed in Section 2.5, the *fear appeals* theory called Protection Motivation Theory is extensive enough to be used in any threat situation, such as those involving environmental issues (Floyd *et al.*,

2000). However, due to this study not including any measurement on self-efficacy, it is difficult to use this theory to discuss the results. Linking to Section 2.3.2 and how climate change communication would be successful, an impacts framing made participants aware of a threat and a solutions framing of how to mitigate the threat. To fully use Protection Motivation Theory, both framings would need to be combined and elements of efficacy being included. The advised behaviour was to participate in pro-environmental behaviour and both framings led to the intention to engage in this to increase. This finding can perhaps lead to the assumption that the information must have been presented in an accessible manner.

## **6.4 Impacts & Solutions Combined Framing**

Analysis of the results for this present study seem to suggest that a combined framing approach would be the most effective form of communication to positively change participants pro-environmental behaviour. An attempt will now be made to find support for this idea by using the interviews carried out. Some students came to this agree with this view on their own, while some shared this view once they were made aware at the very end of the session, that the study was framing the topic as impacts and solutions in separate sessions. Below are comments representing this, from two students living in Singapore who had the impacts framing:

*Student: Solutions is a good thing to add because at the end lots of people will feel like, the press will feel like oh my gosh we've ruined our planet we are all going to die. But if you showed solutions you could like change everybody and make people more optimistic to try and reach their solutions and stuff*

*Student: First show the consequences and show what we can do to stop those consequences*

Patchen (2006) states that for climate change communication to be most effective at encouraging people to take action, the threat should be clearly shown and combined with how to deal with this threat on an individual and group level. The benefits of dealing with the threat should also be communicated. The messages should also be adapted to the values of different audiences and presented by individuals who are trusted. Riede, Keller and Greissing (2016) go further by saying that the solutions of climate change should be focused on communicating action to an individual level. Images should be used that don't threaten and that link to emotions and concerns felt each day, allowing people to engage with the issue.

## **6.5 Students Age And The Framing Effect**

Variables such as age, gender, education and income have been suggested in previous research to be linked to pro-environmental behaviour (such as Felonneau & Becker, 2008). This section will focus on students aged 12 and 14. Neither framing led to a significant change in the pro-environmental behaviour of 12 year old students, with a much greater change seen for both framings for 14 year old students. At such a young age, perhaps 12 year olds found it difficult to relate to climate change and had not yet developed the ability of abstract thinking. Perhaps they find it hard to see how climate change directly relates to them and how their personal action is necessary. A different approach, such as by changing the framing format, presentation style and content should be potentially used for this age-group.

14 year olds seemed to grasp both framing concepts and were influenced to increase their pro-environmental behaviour by much greater amounts, with the impacts framing being the most successful. Perhaps the level of content in the presentations was targeted right for this age group. A child goes through major physical and emotional changes between the ages of 12 and 14. Perhaps the older students have a greater affinity with the world and are more mature. Maturity has been linked with pro-environmental behaviour, such as by Borden and Francis (1978). The subjects taught at school for these age-groups will also differ, with the 14 year olds expected to have more knowledge and awareness on climate change.

Many previous studies have found that younger people have higher levels of concern with environmental issues, but that many issues were found with how this data has been manipulated. Further research suggests that the relationship between age and levels of concern on the environment should follow a similar pattern to that of age and volunteering in politics. Middle aged people tend to have the highest activity in politics and public issues, with younger and older people being much less interested, due to being more concerned about private issues (Franzen and Meyer, 2010).

Lynn (2014) looked at pro-environmental behaviour of adults in three categories: at home, transport and purchasing behaviour. An increasing age led to acting more environmentally friendly at home. The effect of age on the likelihood to carry out pro-environmental behaviour can be complicated, as it can vary depending on the category or type being discussed. Young adults have been found to act in a more environmentally friendly way towards transport, than they are towards behaviour at home (Lynn, 2014). The effect of framing on age for teachers was not investigated, due to the small samples sizes in both framings and the large age-ranges.

However, age is not a definitive variable to use. A more precise measurement of age (i.e. to the nearest month) was not collected. Gender and nationality are much more definitive and these will now be discussed in Sections 6.6 and 6.7.

## **6.6 Student's Gender And The Framing Effect**

The results show that an impacts framing had a greater influence on boys than girls, with girls having very similar results under both framings. By examining the content of the framing presentations, this could lead to the suggestion that the imagination of boys was captured more by images of for example, graphs showing rising temperatures and sea-levels, rather than by images of renewable energy and reforestation. The level of significance for differences in pro-environmental behaviour for males under an impacts and a solutions framing was at  $p=0.07$ , which suggests near significance and there could possibly be a trend. Further research into gender and a framing effect is required. This will be discussed further in Section 6.14 and 6.15.

The global study called the Relevance of Science Education (ROSE) was conducted by Schreiner and Sjøberg, (2010). It collected data in 40 countries and looked at the attitudes of 15 year olds on certain aspects in science and technology within education and society. Their results in relation to the environment showed that girls are more likely to believe that an individual can make a difference. This leads to the result that girls have a higher level of self-efficacy than boys. More girls than boys agreed with the statement of *"people should care more about protection of the environment"* and *"I can personally influence what happens with the environment"*. More boys than girls agreed with the statement of *"environmental problems should be left to the experts"* and

*“science and technology can solve all environmental problems”*. This difference in opinion could explain why in this study, boys didn’t seem to engage with the solutions framing. The ROSE study also found that boys were much more interested in explosive chemicals. This interest in explosions could be linked for example to a greater interest in the catastrophic consequences of climate change, hence why boys were influenced much more by an impacts framing. Boy’s interests were found in the following areas: *technical, mechanical, electrical, spectacular, violent and explosive*. Girl’s interests were *health and medicine, beauty and the human body, ethics, aesthetics, wonder and speculation* (Schreiner and Sjøberg, 2010).

Some studies show that women tend to be more concerned about the environment than men (Franzen and Meyer, 2010) and they are more likely to carry out pro-environmental behaviour ((Zelezny, Chua and Aldrich, 2000; McFall and Garrington, 2011). This trend was found in the two behaviour categories of spending more money for environmentally friendly goods and when it gets cold to wear more clothes (McFall and Garrington, 2011). In previous studies it has been suggested that in general, women are more interested in social aspects, compared to men who are predicted to more likely take risks and act in a brave manner (Félonneau and Becker, 2008). An impacts framing led to boys increasing their pro-environmental behaviour. By using the same assumptions as discussed in Section 6.2, it could be argued that an impacts framing led to males carrying out more risk-averse behaviour, which goes against the statement above. With a solutions framing leading to a smaller increase in boy’s pro-environmental behaviour, it could be argued that this brought about more risk-taking behaviour and so agreeing with the statement above.

## **6.7 Student’s Nationality/Location And The Framing Effect**

When a sub-sample of students from two international schools in Myanmar were investigated further, it was shown that an impacts framing led to a large increase in pro-environmental behaviour, both for local and foreign students. A relatively equal increase for seen for both. This was a surprise, as these foreign students would all have varying experiences from their home nations, as well as also other countries that they have lived in worldwide. It is very common for students in the international school system to move schools regularly. This is often due to their parents moving to different countries, due to new job postings such as in embassies. Myanmar is one of the poorest countries in south-east Asia, with 25.6% of the population living below the poverty line (Asian Development Bank, 2017). This could lead to the assumption that an impacts framing is a successful method of framing climate change, when communicating this topic to audiences in the poorer countries of the world.

Due to both local and foreign students in Myanmar having similar levels of increase in pro-environmental behaviour under an impacts framing, it could be assumed that location has a large effect on the intention to engage in pro-environmental behaviour. The “All Other Students” category used as a comparison, which had a much smaller increase in pro-environmental behaviour under an impacts framing, was primarily composed of students at a school in Singapore. It should be noted that no solutions framings were carried out to students in Myanmar or Singapore, so are not available for comparison.

In Myanmar, there is much less frequent access to information, with only 21.8% of the population having access to the internet (Asian Development Bank, 2017). In Singapore, internet is much more accessible everywhere, with information always readily available.

Perhaps the students in the poorer country of Myanmar feel more threatened by the impacts of climate change, compared to those living in Singapore which has a greater capacity to adapt.

## 6.8 Student's Climate Change Beliefs And The Framing Effect

For students in the categories of being *convinced* and *unconvinced* about climate change, an impacts rather than a solutions framing is shown to be a more effective way to change their pro-environmental behaviour. An impacts framing led to a greater increase in pro-environmental behaviour for *unconvinced* students than *convinced*. Perhaps the impacts framing created a feeling of fear that stimulated them into action, as well as increasing their knowledge and awareness of climate change. For *convinced* students, the impacts framing re-affirmed their beliefs. The small sample of students in the *unconvinced* category was expected, as this present study was carried out in international schools and these usually have an excellent level of education.

Reasons for people not believing in human-caused climate change are affected by past values, with an example being how an individual voted (i.e Republican or Democrat in the US) (Heath and Gifford, 2006). This was found to be more important than if they had any issues in interpreting the evidence provided by scientists or the media. Hence, extra information being provided to climate change sceptics, denialists and those that are *unconvinced* will have little effect at changing their views (Sapiains et al., 2016). Despite this, the framings used in this study have increased *unconvinced* participants' pro-environmental behaviour and so it could be argued that it is a successful way to communicate climate change to this group.

Bain et al., (2012) suggests that to increase the pro-environmental behaviour of climate change deniers, more focus should be placed on the ways climate change mitigation will lead to an improved world, rather than on the impacts and how to avoid them.

## 6.9 Pro-environmental Behaviour Categories

This present study focused on the seven pro-environmental behaviour categories of transport, water, meat, electricity, recycling, packaging and encouraging environmentally friendly behaviour. Results for students aged 12 and 14 respectively (Figure 20 and 21) show that for some categories, framings caused a negative effect on the intention to carry out pro-environmental behaviour. This was not shown in the overall pro-environmental behaviour results (Figure 15) and so presents a more detailed and complicated picture. Some of the largest increases were seen in the categories of transport, water and meat. Perhaps it's much easier for students to relate to everyday use of these categories, with much simpler and easier actions able to be taken to reduce usage.

In Section 6.7, it was suggested that location had a large effect on the intention to engage in pro-environmental behaviour. In Myanmar, there is for example a severe lack of infrastructure in recycling and cycle lanes. These differences in infrastructure between countries may affect students' answers to the pro-environmental behaviour questions

The approach taken in this study regarding pro-environmental behaviour can be compared to a study by Wynes and Nicholas (2017). They have called for a re-think of the individual actions that people can take, with regards to individual mitigating behaviour. They suggest four different actions that they describe as being *high-impact*, with regards to reducing emissions and also state the

relative emission reduction for each action. These include having one less child, not having a car, not flying and eating a diet that is “plant-based”. *Low-impact* actions, with the examples of recycling and using more environmentally friendly light-bulbs are what this project focused on, with regards to pro-environmental behaviour.

## 6.10 Sources of Environmental Information

Participants were asked to answer the open question of *what have you learnt? Is there anything that you didn't understand?* (Part Two (Box One)) straight after the Basic Climate Science presentation. With the most common answer found being the phrase “97%” for students and teachers shows that this fact was new information for many. This refers to the fact communicated in the presentation that 97% of climate scientists agree that humans are the main cause of current climate change. Perhaps this surprise is due to the mass media communicating climate change as more of a debate, such as by giving more time to denialists than should be.

## 6.11 Spillover Effect

This present study did not include any direct measurement of the spillover effect, but results from the interviews have inferred the importance of parents to students. This is the opposite trend to the spillover effect, which focuses on the influence that children can have to their families (Hiramatsu *et al.*, 2014). In the interviews, students inferred that parents had a big influence on them, with regards to themselves carrying out pro-environmental behaviour. The most engaged students who took part in the interviews were the individuals who spoke about their own parents' efforts in carrying out mitigating behaviour. Below are some examples of this from student's studying in Singapore and Myanmar respectively.

*Student: And I'm actually I've focused quite a lot on climate change in our family especially because my Dad he works for an oil and gas company and we've talked quite a lot about it and we've watched quite a lot of planet earth where they talk a lot about climate change and we know a lot about what is happening and how we can help. So my Mum she is a big foodie so we always buy mostly organic and food that doesn't come from far away in the world, we try to reduce our carbon footprint as much as we can*

*Student: For me my parents have a lot of awareness about this. My Dad is quite very well working towards clean living and you hear a lot about it and I figure it out from the radio, also from the newspapers, also it's mostly my parents who talk about it and then I learn from them. But I was keeping up with stuff that was happening in like, I was keeping up with all that was happening*

## 6.12 Limitations And Potential Reasons For Rejecting The Hypothesis

Every student and teacher who participated in the project received the Basic Climate Science presentation. In this, graphs showing the large increase in greenhouse gases were included. An image used on the front page of the impacts framing was of fossil fuels released from factories, so a link between the two may have been made by students (the burning of fossil fuels releases greenhouse gases). It could be argued that this infers an impacts framing and negatively orientated communication. This example above may have influenced student's pro-environmental behaviour results, by doubling the effect of the impact framing message. This may also have influenced

student's views on the solutions framing. The main aim of the Basic Climate Science presentation was to increase participant's knowledge on climate science, which would then help them to understand the framings. Results from interviews gave the impression that some students felt that by just receiving the solutions framing, this gave the impression that the issue of climate change is already solved. Perhaps this shows once again that a better form of communication would be to combine the impacts and solutions framing. Below is a student at an international school in Myanmar interviewed after an impacts framing:

*Student: But if you tell them the solutions then they're like, oh things are not that bad*

For the pro-environmental behaviour questions, a more detailed Likert scale with a label given to each number and more numbered choices would have increased the reliability of participant results. It could also be argued that students would view choosing point one (*not at all likely*) or point five (*very likely*) as being extreme behaviour. Also, the participants are left wondering if there is the same distance between each choice available (Bishop and Herron, 2015). As there were five choices, students could possibly have assumed that point three in the middle was "neutral" and this choice may have been chosen if students were unclear on the question. The Not Applicable (NA) choice was there, which some participants may have chosen if they felt they were in a rush to complete the task, or were unwilling to do so. For some participant's results, there was a difference between NA choices for each of the seven pro-environmental behaviour questions, in Part One and Part Three. A different way to represent the seven pro-environmental topics could be to use a similar structure as by Ojomo *et al.*, (2015), to reword the question and use the detailed choices of *Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree*.

The majority of students in each audience were very excited before the session, probably because they were being taken out of the classroom to meet a new "face". Most students had already been forewarned that they were to have a session on climate change and were to take part in a research topic. This would have meant students arriving for the session already thinking about climate change and perhaps already forming their own framing. For this present study in south-east Asia, 90% of students in the impacts framing answered "Yes" to having learnt about climate change previously in school, compared to 84% in the solutions framing. This is slightly higher than the 65% found in the preliminary data collection, which took place in the Middle East. Conversations with students and teachers indicated that schools taught climate change in different ways and from different viewpoints. This then gives students a framing of climate change already, which could have affected their intention to engage in pro-environmental behaviour. Students would also have learnt about climate change from various sources, such as in the media, in the classroom and text-books. Below is the answer given by a student interviewed after an impacts framing, who was very optimistic about climate change and was already aware of the solutions available:

*Student: Because like some of the things people are already starting to do to try and build and stop climate change is really inspiring, like people are doing everything they can, they're like building new things, they're inventing things that can help us*

Due to time constraints for being in south-east Asia, it was decided that the post-framing pro-environmental behaviour results were to be collected straight after the framing presentation. This is different to previous studies using a similar method of collecting data before and after a presentation. Harker-Schuch and Bugge-Henriksen (2013) waited much longer to collect their post-presentation data, with the questionnaire given to students approximately one month later. This would allow time for students to digest and form an opinion on the presentation, but could also



allow for information learnt to be forgotten, which would then affect the results collected. To find a balance, background information questions were asked immediately after the framing. This provided students with a short break before they re-answered the pro-environmental behaviour questions and gave them a brief chance to digest the topics covered in the framing and to formulate their views. It is also possible that the framing presentations inferred some self-efficacy, which could help to explain the large increase in pro-environmental behaviour after an impacts framing. This would agree with the thought that *fear-appeals* messages only truly work when efficacy messages are included with them (Witte and Allen, 2000).

### 6.13 Bias

Data collection carried out in the international schools was convenience sampling. Visits to these schools had already been scheduled prior to the formation of the project. For some sessions, the study had to make do with the samples that the school provided. This led to the large age-range and many different nationalities of students that participated in the study, as well as the different circumstances in which the two teacher's sessions took place.

When using particular words to investigate students' feelings (Section 3.3.8 and 5.3), two more negative words (eleven) were used than positive words (nine). It could be argued that this is a biased method and the same number of positive and negative words should have been used. To investigate student's beliefs on climate change (Section 3.3.3.3 and 5.7), only three questions were asked, with one categorised into *convinced* and two for *unconvinced*. This was the same method as used in Bain et al., (2015), but a better method would be to have two questions for each category, such as adding in *I believe climate change is occurring, and humans are having slightly significant effects on climate change*. This would have been categorised into being *convinced*. There was no standard script used by the presenter for each framing, but the same format and slides were used each time. The presenter always aimed to keep the words and phrases used exactly the same when carrying out each framing, but the reader should be made aware that the slight change in tone or words used may have affected results during data collection.

### 6.14 Summary: Findings To Improve Science Education

- Combine impacts and solutions framing presentations.
- Carry out impacts framing to boys and either framings to girls and/or combine.
- 12 year old students are too young and not yet mature enough to be encouraged to carry out pro-environmental behaviour. New method is required to be developed and tested.
- 14 year old students are mature and developed enough to learn about climate change.
- Carry out an impacts framing in poorer countries (but no comparison with Solutions possible).
- Parents play an important role in encouraging and influencing students' pro-environmental behaviour.
- Living location plays an important role in intention to engage in pro-environmental behaviour. Climate change communication should be focused on local impacts and solutions.

## **6.15 New Hypotheses**

The findings from this study have led to the formulation of the following hypotheses that require further testing:

1. A combined impacts and solutions framing is the best form of climate change communication.
2. Girls have a higher intention to carry out pro-environmental behaviour than boys.

## **6.16 Environmental Awareness**

All paper surveys were recycled and a donation was made to a company to offset the project's flying emissions, with the money being re-invested into a mitigation project such as reforestation. A carbon dioxide calculator was used to total up emissions created from return flights from Copenhagen to Kuala Lumpur (via Istanbul).

## 7.0 CONCLUSION

The aim of this study was to investigate the effect that an impacts and a solutions framing has on the pro-environmental behaviour of students and teachers at international schools in south-east Asia, and to discuss the implications these findings have for science education. The results suggest that *fear appeals* communication should continue to play an important part in the future to influence an individual's intention to behave in a more pro-environmental way. Focusing on solutions is a new and upcoming form to communicate climate change, i.e. the "positive" stories of climate change mitigation, such as technological advancements and mitigation projects being carried out worldwide. This allows a more positive message to be communicated, moving away from the usual doom and gloom rhetoric associated with impacts framing. However, the findings in this study show that communicating a solutions framing on its own may not be the most effective method in changing an individual's pro-environmental behaviour.

The study's most interesting findings, which could have the greatest implication for science education, are that the combination of an impacts and solutions framing is suggested to have the greatest effect on pro-environmental behaviour. Findings that could also aid in the development of future interventions are the effect of maturity, gender differences and importance of location, all on an individual's intention to carry out pro-environmental behaviour. The different response observed due to location points towards communicating climate change impacts and solutions with relevance to an individual's local area. An example of this was seen during discussions in schools in Myanmar about the implications of deforestation currently taking place in the north of the country. Communicating climate change at a local level makes the issue more relatable and understandable (Rayner and Malone, 1997) and is an important area for further research. A study by Chowdhury, Maiti and Bhattacharyya (2016) investigated how to communicate climate change 'impact and solutions' to vulnerable populations of Indian Sundarbans. The conservation of endemic knowledge and education of local populations could be important for the development of adaptation programmes and the communication of climate change issues. An example is the reforestation of mud-flats with mangroves (Chowdhury, Maiti and Bhattacharyya, 2016).

It is clear that climate change education has no 'one fits all' solution and that a multitude of different variables and factors need be taken into account when designing educational material and determining school syllabuses. The findings of this study may be useful in helping to encourage future generations to learn and engage in environmental topics such as climate change and to carry out pro-environmental behaviour.

Climate change communication should be carried out using the most appropriate methods and styles within schools and within science education as well as different societal levels and locations around the world. This will ensure that people worldwide are encouraged to support mitigation projects, which will hopefully enable future generations to continue to adapt and prosper on this beautiful and precious planet we are so lucky to call home.



## 8.0 FURTHER WORK

- Combine impacts and solutions framings to create a medium level of fear. Test and measure pro-environmental behaviour.
- Include a measure of self-efficacy to further understand its effect on *fear appeals* messages.
- Include *risky choice framing* statements in a survey, such as loss vs gain (lives saved vs lives lost).
- Use questions such as: *how likely are you to spend money to cover your flight emissions?*
- Explore the *high-impact* examples of pro-environmental behaviour and compare to *low-impact*.
- Use younger age-groups in data collection to further understand the effect of maturity. Compare this to further research on the 14-16 year old age-range.
- Carry out research work in local schools and examine existing knowledge and levels of pro-environmental behaviour. Compare educational methods used to those in international schools.
- Investigate the importance both-ways of environmental interaction between parents and students.
- Use other educational institutions, such as museums.
- Investigate gender differences between age-groups with regards to intention to carry out pro-environmental behaviour.
- Test the effect of focusing climate change communication on local impacts and solutions.



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# 10.0 APPENDIX

## 10.1 Table A18

		Solutions	Impacts	Total
Negative	anxious	0	0.74	0.74
	sad	3.29	18.1	21.4
	guilty	3.89	4.44	8.33
	shock	2.09	10.3	12.4
	surprise	4.79	8.14	12.9
	scare	0.29	6.29	6.58
	fear	0	0.74	0.74
	bad	2.39	14.1	16.49
	bored	2.99	0.37	3.36
	worried	0.89	7.03	7.92
	upset	0.29	3.33	3.62
Positive	interest	16.7	5.55	22.3
	save	1.79	2.59	4.38
	inspire	2.09	0	2.09
	hope	2.69	1.48	4.17
	reduce	2.09	1.11	3.2
	difference	3.59	1.11	4.7
	good	3.89	2.22	6.11
	confident	0.59	0.37	0.96
	happy	2.99	1.48	4.47

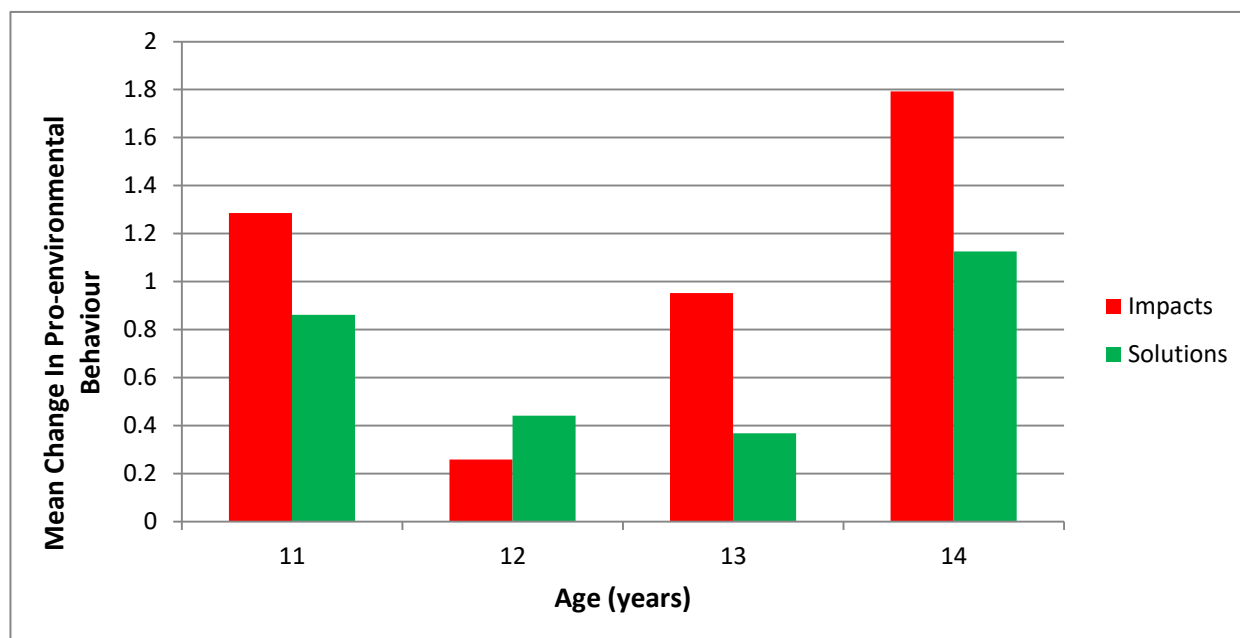
**Table A18.** The occurrence (%) of negative and positive words to describe student's feelings after a framing of climate change. Total = 604 students. Impacts = 270 students; Solutions = 334 students.

## 10.2 Table A19

		Solutions	Impacts	Total
Negative	anxious	0	0	0
	sad	0	2.33	2.33
	guilty	0	2.33	2.33
	shock	0	18.6	18.6
	surprise	0	6.97	6.97
	scare	0	2.32	2.32
	fear	0	0	0
	bad	0	0	0
	bored	3.57	0	3.57
	worried	3.57	20.9	24.47
	upset	0	2.33	2.33
Positive	interest	3.57	13.9	17.47
	save	0	0	0
	inspire	0	0	0
	hope	17.8	6.97	24.77
	reduce	3.57	0	3.57
	difference	3.57	0	3.57
	good	7.14	4.65	11.79
	confident	0	0	0
	happy	0	0	0

**Table A19.** The occurrence (%) of negative and positive words to describe teacher's feelings after a framing of climate change. Total = 71 teachers. Impacts = 43 teachers; Solutions = 28 teacher.

## 10.3 Figure A30



**Figure A30.** Pro-environmental behaviour for students aged 11-14 under a framing (Impacts and Solutions). Total = 562 students: Impacts = 234 students; Solutions = 326 students. 11 year olds = 65 students: Impacts = 35 students; Solutions = 29 students. 12 year olds = 203 students: Impacts = 58 students; Solutions = 145 students. 13 year olds = 228 students: Impacts = 83 students; Solutions = 144 students. 14 year olds = 66 students: Impacts = 58 students; Solutions = 8 students.

## 10.4 Table A20

Age (years)	Impacts	Solutions	P-value
11	1.29	0.86	0.65
12	0.25	0.44	0.84
13	0.95	0.36	0.35
14	1.79	1.12	0.6

**Table A20.** Pro-environmental behaviour for students aged 11-14 under a framing (Impacts and Solutions). Total = 560 students: Impacts = 234 students; Solutions = 326 students. 11 year olds = 64 students: Impacts = 35 students; Solutions = 29 students. 12 year olds = 203 students: Impacts = 58 students; Solutions = 145 students. 13 year olds = 227 students: Impacts = 83 students; Solutions = 144 students. 14 year olds = 66 students: Impacts = 58 students; Solutions = 8 students.

## 10.5 Table A21

Age (years)	Framing	Transport	Water	Meat	Electricity	Recycle	Packaging	EF
12	Impacts	0.36	0.12	-0.14	0.07	-0.12	-0.14	0.1
	Solutions	0.14	0.16	0.12	0.02	-0.06	0.09	-0.04

**Table A21.** The mean change in pro-environmental behaviour per category for 12 year old students under a framing (impacts and solutions). Total = 203 students. Impacts = 58 students; Solutions = 145 students.

## 10.6 Table A22

Age (years)	Framing	Transport	Water	Meat	Electricity	Recycle	Packaging	EF
14	Impacts	0.34	0.53	0.36	0.24	0.28	-0.03	0.07
	Solutions	-0.25	0.38	0.63	0.13	0	0.38	-0.13

**Table A22.** The mean change in pro-environmental behaviour per category for 14 year old students under a framing (impacts and solutions). Total = 66 students. Impacts = 58 students; Solutions = 8 students.

### 10.7 Table A23

Scale	Importance Of Climate Change	Occurrence (%)
Not Applicable (NA)	10	1.67
1 Strongly Disagree	4	0.66
2	5	0.82
3	10	1.65
4	66	10.9
5	131	21.7
6	192	31.8
7 Strongly Agree	186	30.8

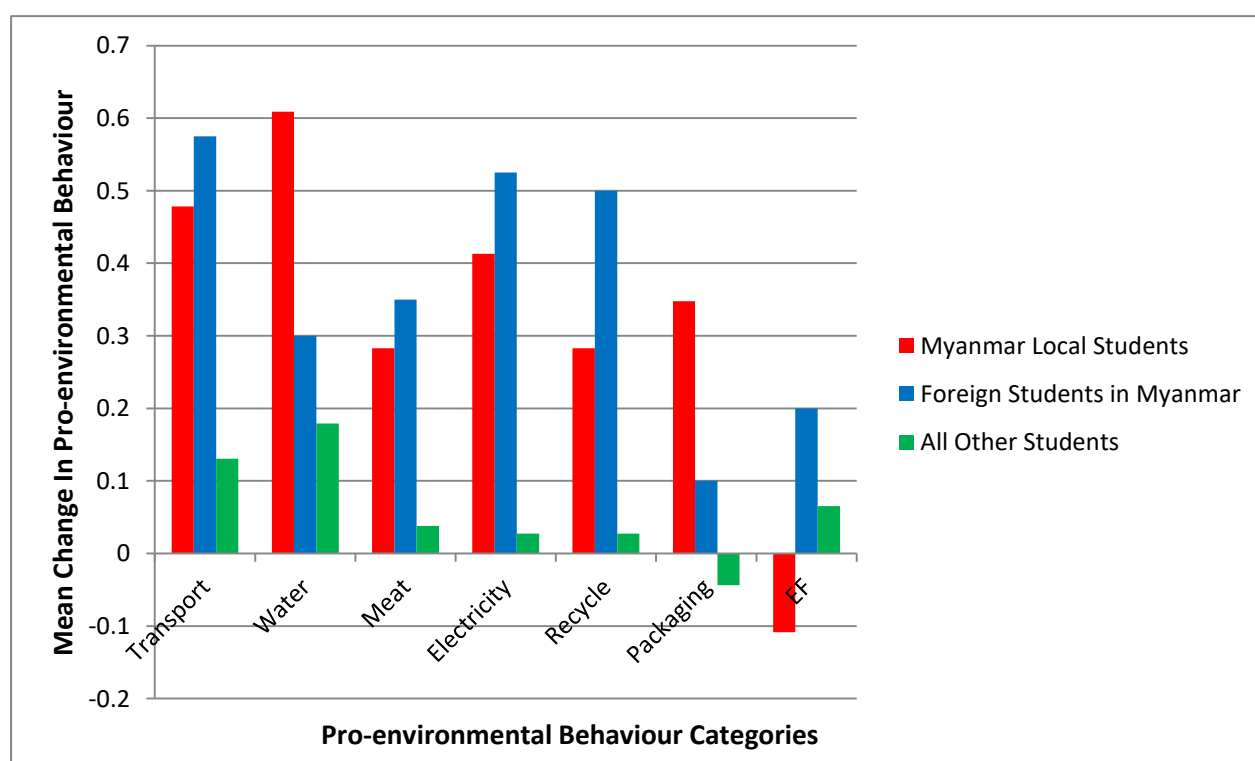
**Table A23.** Student participant views on the importance of climate change. Total = 604 students.

### 10.8 Table A24

Statement	Number Of Students	Occurrence (%)
Not Applicable (NA)	4	0.66
A (Convinced)	552	91.4
B (Unconvinced)	40	6.62
C (Unconvinced)	8	1.32

**Table A24.** Student participant beliefs on climate change. Total = 604 students.

### 10.9 Figure A31





**Figure A31.** Pro-environmental behaviour change for each category for Myanmar Local Students, Foreign Students in Myanmar and All Other Students who had the impacts framing. Local = 46 students, Foreign = 40 students, All Other = 184 students.

### 10.10 Table A25

Category	Transport	Water	Meat	Electricity	Recycle	Packaging	EF
Myanmar Local Students	0.47826087	0.608695652	0.282608696	0.413043	0.282609	0.347826	-0.1087
Foreign Students in Myanmar	0.575	0.3	0.35	0.525	0.5	0.1	0.2
All Other Students	0.130434783	0.179347826	0.038043478	0.027174	0.027174	-0.04348	0.065217

**Table A25.** Pro-environmental behaviour change for each category for Myanmar Local Students, Foreign Students in Myanmar and All Other Students who had the impacts framing. Local = 46 students, Foreign = 40 students, All Other = 184 students.

Country:

School:

Date:

## 10.11 (A1) Survey

**Welcome to this research project** and we really appreciate you being involved! Begin to now work on **Part One**. Please make sure that your answers are your own.

---

### Part One (10 minutes): Please fill out your details below

1. Age:
2. Gender: (circle your choice)

Male                      Female

3. Nationality:
4. Read the statement below and circle a number from 1 to 7:

1 = strongly disagree and 7= strongly agree

**Statement:** *“Addressing climate change is one of the most important issues facing society today”*

Strongly disagree    1    2    3    4    5    6    7    Strongly agree

5. Choose one of the 3 statements that you believe is most correct, by circling either A, B or C.
  - A) *I believe climate change is occurring, and human activities are having significant effects on climate change*
  - B) *I believe climate change is occurring, but human activities are not having significant effects on climate change*
  - C) *I do not believe climate change is occurring*

## Pro-environmental behaviour questions (1)

**How likely are you to engage in the following activities in the next 12 months?** (If it is not possible for you to perform an activity, please choose 'not applicable'.)

(1 = not at all likely, 5 = very likely, NA = not applicable.)

1. How likely are you to use the following to travel to school: walk, cycle or use public transport?

NA    Not all likely    1    2    3    4    5    Very Likely

2. How likely are you to reduce the amount of water you use when having a shower/washing up/running a tap?

NA    Not all likely    1    2    3    4    5    Very Likely

3. How likely are you to reduce the amount of meat you eat?

NA    Not all likely    1    2    3    4    5    Very Likely

4. How likely are you to turn off electricity when it's not being used?

NA    Not all likely    1    2    3    4    5    Very Likely

5. How likely are you to recycle plastic, paper, cardboard and glass?

NA    Not all likely    1    2    3    4    5    Very Likely

6. How likely are you to buy products that have less packaging?

NA    Not all likely    1    2    3    4    5    Very Likely

7. How likely are you to encourage friends & family to act more environmentally friendly?

NA    Not all likely    1    2    3    4    5    Very Likely

**Part Two (30 minutes):** You will now be given a presentation, split into two sections. **When asked, please read the questions and write in the correct box:**

Box One: what have you learnt? Is there anything that you didn't understand?

Box Two: how did you feel during this part of the presentation?

**Part Three (10 minutes):** After the presentation has finished, answer the following background questions below. Then once again answer the same pro-environmental behaviour questions, as were asked earlier in Part One.

**Background information questions**

\*Environmental issues are defined as problems with the planet's systems (air, water, soil, etc.) that have developed as a result of human interference or mistreatment of the planet.

1. On average, how often do you discuss environmental issues\* with your family per week?

More than 5 times      3 to 4 times      1 to 2 times      Less than one time      Never

2. On average, how often do you discuss environmental issues\* in the classroom with teachers per week?

More than 5 times      3 to 4 times      1 to 2 times      Less than one time      Neve

3. On average, how often do you discuss environmental issues\* with your friends per week?

More than 5 times                      3 to 4 times                      1 to 2 times                      Less than one time                      Never

4. While watching television at home and an environmental programme comes on, how likely are you to change to something else?

NA                      Not at all likely                      1                      2                      3                      4                      5                      Very likely

5. What do you use to learn and read about environmental issues\*? (You can choose more than one option.)

N/A                      Social media                      Magazines                      Newspapers                      TV                      Radio                      Other (please specify)

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6. Have you learnt about climate change before in school?

Yes                      No                      Unsure

7. How likely are you to work on the protection of the environment in the future? (As a job, volunteering etc).

Not at all likely                      1                      2                      3                      4                      5                      Very likely

8. What is the highest level of education that your parents have?

N/A                      Primary school                      Secondary school                      College/Sixth Form  
Undergraduate                      Postgraduate                      PhD                      Other (please specify)

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## Pro-environmental behaviour questions (2)

**How likely are you to engage in the following activities in the next 12 months?** (If it is not possible for you to perform an activity, please choose 'not applicable'.)

(1 = not at all likely, 5 = very likely, NA = not applicable.)

1. How likely are you to use the following to travel to school: walk, cycle or use public transport?

NA                      Not all likely                      1                      2                      3                      4                      5                      Very Likely

2. How likely are you to reduce the amount of water you use when having a shower/washing up/running a tap?

NA    Not all likely    1    2    3    4    5    Very Likely

3. How likely are you to reduce the amount of meat you eat?

NA    Not all likely    1    2    3    4    5    Very Likely

4. How likely are you to turn off electricity when it's not being used?

NA    Not all likely    1    2    3    4    5    Very Likely

5. How likely are you to recycle plastic, paper, cardboard and glass?

NA    Not all likely    1    2    3    4    5    Very Likely

6. How likely are you to buy products that have less packaging?

NA    Not all likely    1    2    3    4    5    Very Likely

7. How likely are you to encourage friends & family to act more environmentally friendly?

NA    Not all likely    1    2    3    4    5    Very Likely

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## Thank-you for taking part!

Go to [www.magoce.com/research](http://www.magoce.com/research) for more information

A small group of you have already been selected to meet Henry for a short discussion/interview as a follow-up. If you are one of these people, please tick the box below and follow the instructions now given.

Yes I have been chosen to take part in the follow-up interview discussion session

## 10.12 (A2) Interview Questions

Thank-you for agreeing to take part in this interview discussion forum.

Earlier on today you took part in a survey. The group discussion will be audio recorded and will only be used for the purpose of this research project. Nothing will be published regarding recognition of a particular individual.

Please see the list of questions below. You will now be given 5 minutes to read through them and to give you a chance to think about your answers. Please do this by yourself and after we will discuss these together as a group.

1. How interested were you in climate change before this presentation?
2. Did the presentation make you become more interested & willing to learn about the topic? And to change the behaviour of others? If not, why?
3. Do you feel anxious at all about climate change? If so, did you already feel this before the presentation?
4. Do you feel optimistic at all about climate change? If so, did you already feel this before the presentation?
5. Do you view climate change as “doom and gloom”, or more as an opportunity for the world to transform itself for the better?
6. Do you agree with the presentations point of view?
7. Do you feel that an individual can make a difference on reducing the effects of climate change?

## 10.13 (A3) Interviews

### 10.13.1 (A3.1) Nexus International School, Singapore – 15<sup>th</sup> March 2017

P: So it's the 15<sup>th</sup> March, this is Nexus International School in Singapore. The first interview. So guys thank-you for joining me, completely informal. Question 1, how interested were you in CC before this presentation? Could someone start me off, how interested were you? Yes...

S: My family, we try to reduce most of our stuff. My Dad tells me, oh don't buy this cos it comes from a different place, oh don't buy this cos its too expensive, its like my Dad is a good like, hes not exactly eco-like, hes not like crazy about being good for the environment but he just wants to like have a nice amount of like not too crazy yet enough to know.

P: Okay yep...

S: I was interested in Climate change because I like playing in the snow in Finland and I think it's a bad thing.

P: Okay yep...

S: I was highly interested like I had already done many things like beach clean ups and stuff to try and raise awareness for climate change because I am 100% against what like oil companies and stuff, what they are doing at the moment, like they are not actually doing anything to help. But now with these inventions that people have made which can get rid of garden gas but nobody buys them

P: Okay

S: Or nobody funds them

P: Okay yep, yep

S: And I'm actually I've focused quite a lot on climate change in our family especially because my Dad he works for an oil and gas company and we've talked quite a lot about it and we've watched quite a lot of planet earth where they talk a lot about climate change and we know a lot about what is happening and how we can help. So my Mum she is a big foodie so we always buy mostly organic and food that doesn't come from far away in the world, we try to reduce our carbon footprint as much as we can.

P: Fantastic okay. My next question is, do you feel anxious at all about climate change? Did you already feel this before the presentation? Yes...

S: I was, I felt quite anxious because I felt like after a certain graph they made in class I'll be honest how sharply the CO2 emissions were increasing and this really alarmed me so I began to

P: Nice and loud

S: I began to stop, stop using so many lights in my houses

P: Yep

S: and

P: Nice, yep you just want to carry on



S: So most of the time I like feel like anxious about it like when say I see like when you're just like thinking about things like when you're bored you just stop and think about things. I'm like what the heck are we doing right now like we're like destroying entire like evolutionary trees that have been growing for millions of years and now they're just like going all crazy.

P: Yep yep

S: Sometimes yeah I'm pretty anxious about climate change because I love life, its organisms, it's so rare that we probably won't discover any other life on any other planet for quite a while

P: Do you think the presentation has made you more anxious?

S: Yes

P: Yes or no?

S: Yeah, I always know

P: So that's interesting so you already knew most of what you were taught

S: But the graphs were quite surprising seeing exactly how much it has increased

P: This is nice and then, do you feel optimistic at all? Do you, Is there any kind of optimistic?

S: Yes

S: Yes

S: I think what we should do is...

P: Why do you feel optimistic?

S: Because like some of the things people are already starting to do to try and build and stop climate change is really inspiring, like people are doing everything they can, they're like building new things, they're inventing things that can help us

P: and this is things that you already knew before the presentation?

S: Yes because I'd ...

S: All hope is not lost

S: You know I was feeling quite optimistic because I saw a lot of strange and also cool ideas of how to stop well how to help the environment, for example in certain countries you can actually pay by just recycling.

S: Oh yeah like in Denmark you can recycle bottles and you get cash for it

S: Yeah in Finland you can do that, you get money. I once got \$20 for recycling bottles

S: Yeah pretty sure it's the same thing in Australia

P: Yeah, so these are things that you already knew and that you had already done in class already, but what about the presentation? I spoke about the impacts of climate change, do you agree that is a good way of trying to communicate climate change and trying to improve peoples' behaviour?

S: Yes

P: So you think by talking about the impacts and how bad things are, you think that's a good way?

S: A good way to talk about cute animals dying, yeah it makes people sad

S: Yeah

S: Also it's a good way to talk about solutions because then you know what to do to stop it

S: Yeah

S: Yeah, yeah, yeah

S: Solutions is a good thing to add because at the end lots of people will feel like, the press will feel like oh my gosh we've ruined our planet we are all going to die. But if you showed solutions you could like change everybody and make people more optimistic to try and reach their solutions and stuff.

P: So would you all agree that you think talking about the solutions is a better way to communicate climate change?

S: You need to..

S: Yeah..

S: First show the consequences and show what we can do to stop those consequences

S: At the end though you could also show them what we can do to stop climate change

S: Like if you had a bit more time you could do the Antarctica thing and before the Antarctica thing though, you could do like all the solutions

P: Okay

S: Because that would actually...

P: This is really good, so do you feel that an individual can make a difference of reducing the effects?

S: Yes (in unison)

P: Because, I, remember I spoke about the impacts, I spoke about how bad things are, but do you still think people can make a difference?

S: Yes (in unison)

S: Yes as long as like, as long as I, even if it's only like a small percentage of the population on earth it will still make a big difference, since you know there's like billions of people on earth and like say like I'll need like 100,000 people who go like completely eco-friendly like they like stop eating meat and stuff, it can drastically improve like the way the CO2 and stuff like that go down

P: Okay. Yes...

S: One person can't really change it, but I think if you like raise awareness on social media or like internet or youtube or something like that, then a lot of people will start reacting or if you make public presentations then that will help.

P: Yep, so...

S: Or if you just keep it to yourself then...

P: That's really good, my last question is: By myself coming in and talking to you , do you find that you have benefited in learning about climate change and being able to act and learning about the impact... do you think it's a good thing to know?

S: I think some people were already aware of it, but it was good for them to get a kind of reminder of it and some people weren't aware of it, it was good that you came in and showed everyone what was really happening, and the graphs, I think the graphs were the most interesting because they really showed how, what we've done.

S: Yeah...

P: So my last question is, if I had purely focused on the solutions, if I had spoken to you about renewable energy and it would have been more positive, do you think you would have been more, do you think your behaviour would have increased? Do you think you would have been more interested to learn about climate change?

S: No (in unison)

S: It's like, oh people are doing this but we don't have to worry about anything. You've got to show everything bad and at the end some good things. Like that's the best thing you should do.

S: Because if you only feel good things then everybody is going to think that everything is fine.

S: Everyone is just not, no one is going to do anything because they'll think that it's already been taken care of.

S: Yeah

P: So, so you're all saying that by looking at the graphs, having that kind of negative view is the best way to communicate and add some solutions. That's what we seem to be communicating.

S: That makes everyone really think about it

S: And make something nice about what they are doing.

S: And with adolescents we have talked about global warming but in the presentation we have seen today, it was like in general always stuff that is happening, we didn't really focus that much on CO2 or where it comes from.

P: So that's something you haven't looked at in class really?

S: Not yet

P: Really have you not?

S: It comes from factories and us burning fossil fuels

S: And cows and cow farms

P: But that's something you haven't looked at in class in detail?

S: No, not in detail no.

S: Not too much in detail.

S: They said, oh it comes from a factory and then they didn't say what in the factories produce them, they said it comes from the factory...

P: But today you did learn that, so you think that was a big benefit?

S: Yes (in unison)

S: I already know about it because my Dad works oil and gas

P: So you learned about the sources of the greenhouse gases

S: Yeah and we have like learned that like say cows can produce a big majority of greenhouse gases from all the farms

S: We've been trying to convince my Dad to get a job with windmills instead but it's easier said than done.

S: I heard that in Russia, in Siberia methane comes from the ground in bubbles

S: Yeah

P: Yeah you're right. Okay so guys just one final thing is that, try and remember that your behaviour, it was measured before and it was measured after... how do you think your behaviour, do you think your behaviour has changed at all? I'm talking about the impacts, do you think they're quite similar?

S: Maybe

S: Yes

S: I think they will be quite similar, I'm already trying to do as much as I can

S: I think maybe the amount of meat I eat might change because I think, well maybe, it's like a lot of the time I'll have like meat in the majority of my dinners but I think maybe I can reduce it

P: And that's because you've learnt about it today?

S: Yeah

S: I've been thinking about going vegetarian

P: Okay

S: But there are just some things I don't want to give in

S: Yeah

P: I have the same problem, I have the same problem

S: I can't give up bacon

P: That's 10 minutes, I really appreciate you helping me and that is the end of the session.

### **10.13.2 (A3.2) British School of Yangon – 21<sup>st</sup> March 2017**

P: Okay this is the British School of Yangon and it is the 21<sup>st</sup> March. It is almost 1pm. Well guys thank you joining me. My first question for you is: How interested in climate change were you before this presentation that you had earlier? Could some just start for me, just put your.. Yeah okay.

S: Well I had already known a lot of stuff and I'd been keeping up as I was quite interested in it and I'm a bit more interested because of some of the facts that were shown. But also there are other things that are as important as that, and that I would also like to do.

P: Okay brilliant.

S: I wasn't that interested in climate change at first because I didn't have much awareness about it.

P: And that's exactly why I come into schools and that's really interesting. So you didn't find, you didn't have much interest but after the presentation do you have more interest or are you less interested now?

S: A bit more interest in climate change from the presentation.

P: Fantastic

S: I, before the presentation, I had been interested in climate change, but as ... said I wasn't too interested in it because I wouldn't search up things I would just see it in places and like understand what would happen.

S: I have been a bit interested in climate change but I didn't like research about it, I'd just seen it when my Mother read a book.

P: So this is good, this is interesting. So you're saying that you had heard about it before but you wouldn't research for it, but where did you hear about it? Is it on the news that you'd hear about it or do you read a book or is it mostly the newspapers or on the news?

S: I'd say like on social media

P: Social media yeah

S: I got it from a channel called ABC3 in Australia and there would be something called ABC3 News which would come on every night and I'd sometimes watch it.

S: For me my parents have a lot of awareness about this. My Dad is quite very well working towards clean living and you hear a lot about it and I figure it out from the radio, also from the newspapers, also it's mostly my parents who talk about it and then I learn from them. But I was keeping up with stuff that was happening in like, I was keeping up with all that was happening.

P: Okay, do you feel anxious at all about climate change and if you do, did you already feel anxious before the presentation? So has this presentation made you feel more anxious?

S: Well yes a lot but I was still a bit anxious before because I knew what consequences would happen.

S: I didn't know the consequences about it so I wasn't as scared before but now I am

S: Some time ago we did a whole topic on climate change

P: Because you are in year 7, so you already knew about this yeah

S: So last year at my old school we also did a whole thing on climate change, so I was already quite anxious about it but now I really am, just like I said before, I felt like maybe it was something that would be concluded quite quickly with a lot of people. But I've been reading and like I'm a bit more anxious...

P: Yeah but do you, from the presentation, do you think that you might be more aware of your behaviour and the difference that you could make and the changes you could make? Because it is a big problem, do you think you've become more aware and more likely to change your behaviour?

S: Yeah

P: Yeah?

S: Like its maybe to make our world better, to leave a better world for other people who come like after us. I think I will try to make things better, like try, but already most of, we have compost and we are quite helpful. But also the school is quite far away from our house and taking the bus is quite expensive so there are these people who do have to do something ? (4:33) and also I like my meat.

P: Yeah you see this is very interesting because I focus mostly, your presentation was the impacts and you, it was quite a negative presentation. It was these things are going to happen and did that make you feel quite sad quite doom and gloom and like did you feel this issue was too big so you couldn't make a difference or has it made you more likely to make a difference?

S: More likely because I already walk to school every day since I've moved up the road and I don't really eat much meat, I only eat fish...

S: Yeah and chicken, the problem with me is that meat is like my favourite thing to eat so...

P: Same with me

S: Yeah so I don't think like I could stop eating meat.

P: No but you could choose different meats so...

S: Yeah

P: The main thing is that this has made you more interested in the topic, but it's made you more sad, more anxious. So do you think that's a bit of a problem? Do you think you might think to yourself that this problem is too big, so what can I do? I'm too worried about it.

S: You would want to do something but you can't really because you'd want, yeah spread the word, but some people don't have the heart to try.

S: Also I've been thinking about this quite a lot but I know not really, but I've been thinking a lot of other people have been doing things, why not me? It's something I've been thinking about over the years, other topics mainly other topics that I like to do, but yeah these things are, I am, I think one person can do a lot of change but they just have to be in the right place.

S: But like I think it's made me worried about the future, like I think every people can do it but sometimes they don't want to do it. You know like it's a big problem for people to do alone.

P: You're completely right and so my next question is: do you see climate change as a doom and gloom or do you see it as an opportunity for the world to transform itself? Which way do you see it? Do you see it as doom and gloom because it is... do you see it doom and gloom?

S: I just see it doom and gloom. I don't see how it's an opportunity.

S: I see both

S: Yeah I can understand how people can see it

S: I see both

S: I mainly doom and gloom

S: Yeah because I can see, I just see the consequences. I can see what could happen if we try but yeah...

S: I do see both sides of it but the reason is I don't see fully doom and gloom because of the fact that if I just saw doom and gloom, then everyone would see the doom and gloom...

P: Yeah so this is what I said at the end of the presentation is that I, my project is two parts: one thing is you look at the impacts like you have, but at other school I'm going to talk about the solutions and a more positive outlook – things that we can do to make ourselves be more globally responsible. Do you think that that is a more, that is a better way at talking about climate change or do you think it's important to have both or would you say it should just be impacts? Which one do you think? Should it be mostly solutions and renewable energy or should it be both do you think?

S: Both (in unison)

S: I think both because if you just do impacts some people might now know what the solutions are.

S: Yeah (in unison)

S: Sure it helps

S: If you didn't say, if you didn't, kind of both, because if you only say about the impacts the people they would say, oh it's so doom and gloom they won't know how to, they won't know the solutions

P: They won't know the solutions

S: But if you tell them the solution they they're like oh... things are not that bad.

S: All they would do, yeah they would just tell, yeah but they would tell everyone like oh, do you, you need to save climate change and things but they won't know how.

S: If you just tell them solutions they won't know the impacts or what climate change is

S: Yeah and if you just tell them the impacts they won't know the solutions

S: Yeah but also...

P: Sorry

S: For me it's like, I think they think it's a good thing but like they also think that it's not their job to do and so they don't need to do it.

S: Yeah but it's everyone's job

P: Exactly because you could say well if you aren't doing it why should I do it?

S: Yeah (in unison)

P: Okay that's really interesting. So when you were taught, particularly in year 7, or when you hear about it, do you hear most about the impacts? Is that what you hear all the time? Or do you hear about solutions? I mean you've already told me about growing trees in Australia but is it mostly impacts that you hear in the media and in schools?

S: Yeah the impacts

S: Well also I've been hearing is about the impacts but mostly what I've been hearing about is the causes of the impacts, is what I've been mostly interested in knowing

S: Yeah the causes I also hear

P: And that was kind of the climate science I spoke to you about, about the greenhouse gas graphs

S: That, but also companies, things, people

P: People, companies

S: Companies, like the kind of things that need to be fought. That and how what's bad and then how what's bad can transform into good is mostly what I look at. Like what's going to happen, well I would say that's what will lower the impacts if you get the source away. You won't have any more impacts, it's cleared it away.

S: In English we were something about how to stop climate change, we didn't know the impacts we only wrote about the solutions.

P: Really?

S: We didn't know the impacts

P: Only the solutions

S: Yeah

P: So any particular solutions that you wrote about?

S: Turning off the lights when you leave the room, recycling, using food scraps as compost.

P: And that was in your English class?



S: Yep

P: My last thing to say to you is have you heard about the eco-club? Do you know about the eco-club at school?

S: No (in unison)

P: Because I just had a meeting, I just met, there are three children, they are younger than you. But it's something that I am trying to help, to make it cool. Because what you've said, that could be so amazing if you were in an eco-club, you could change the behaviour of the school, you could then change the behaviour of other schools

S: The world

P: And you keep going. So what I'm doing, I'm now a member of the eco-club at BSY, I am also now a member. And they are looking for more members and that could be something that you do in the future and encourage your friend to join. They are growing a garden; they are going to encourage recycling and everything that we have spoken about. So that is just something to finish with. Okay thank you for your time and end of recording.

### **10.13.3 (A3.3) International School of Yangon – 22<sup>nd</sup> March 2017**

P: Okay good afternoon it's the 22<sup>nd</sup> March, this is ISY, thank you for joining me girls. So the first question is: How interested were you in climate change before this presentation? Before you heard about the impacts and the climate science, how interested were you? Does someone just want to start for me? Did anyone have any interest at all, or did you not know that much about climate change? Yes

S: Before the presentation I actually wasn't aware about climate change like at all. Like we used to talk about it back in elementary but in middle school we reviewed it like a couple of times, but this year we are only doing it now so I wasn't aware of any climate changes.

P: Okay so most of the things that you learnt were quite new, they were quite new concepts. Okay, yes...

S: I wasn't really interested in climate change before the presentation. I actually didn't know the difference between weather and climate change that much and then like I didn't think it was that important and then I was like oh it's a presentation on climate change.

P: Yep

S: I wasn't really interested even like after the presentation but still like I learnt a lot from it, and I believe like I would do something more to help climate change, but as interest I would like really pick a job or like something to do with volunteering.

P: Yeah so do you think the presentation has made you more willing to change your behaviour or learn more about climate change but not particularly work in the area?

S: Yeah

P: That's interesting, yeah

S: So before this presentation I was actually interested in climate change but like I had ideas to promote a better lifestyle and I talked to my family about collecting plastic bags and put them in the car and use them if we go to a supermarket or like stuff. And, but I never really had the motivation to go, to conduct these ideas. So after this presentation my motivation has kind of increased a little bit.

P: Interesting okay, so you might be more likely to do things that are more sustainable

S: Yeah

P: Okay yeah

S: Personally I was aware about the whole entire situation and I knew like information about climate change and all that but like, I wasn't really hashing about it. Like I would tell people to turn out the lights, simple lifestyle changes like that could impact climate change. Like.... said I wasn't like so willing in like participating

P: Yeah, do you feel that has changed? Or do you think it's the same as before the presentation?

S: I think it has changed a bit, like I would participate, like if someone created something like, conducted something that helped change climate change, I would participate in it. But I wouldn't be like someone who would eagerly conduct a whole thing about it.

P: Yep that makes sense. So the next question is: Do you feel anxious at all? So you learnt about the impacts, you saw all about the temperature increasing, the ice melting – does that make you feel quite anxious or do you feel more optimistic about climate change? How do you feel?

S: What do you mean as in optimistic?

P: So do you feel that the future is going to be fine? Or are you worried about the future, has the presentation made you feel even more anxious about it? Yes

S: I don't feel strongly either of it like I lean towards the more anxious side because like it's like different and it's more like the climate changing, like I don't see it as a very good thing. Because it's like the seasons are getting mixed up sometimes, like there's rain in the summer and stuff like that. So like I'm getting confused, I'm not optimistic about it but I'm not anxious also

P: But you're more towards the anxious side

S: Yeah

P: But if I had come here today and I had spoken completely about the solutions and renewable energy and I'd spent the whole time focusing on that, do you think you would be feeling more optimistic and do you think you would be willing to change your behaviour even more? That's the main point of the project, if I'd spoken about impacts instead or if I'd spoken about solutions completely, which one do you think would motivate you more; to change your behaviour and learn more about the actual topic?

S: Personally I think it's better to, for the presentation, talk more about the impacts of climate change rather than talking about the possibilities of helping because like yeah it's just like the negativity kind of spreads around the room.

P: Which you think is a good thing?

S: It would make people more anxious about it, more you know like willing to change the situation.

P: Yep okay. Yes?

S: I don't think it's a good idea to talk about one whole subject, like talk about only the impacts and only about the solutions, because to me I feel like I would have felt slightly more, I would have felt only optimistic if you had only talked about the solutions. And I might feel pessimistic if you only talk about the impacts, so I think it's a good idea to talk about both and yeah this really urged me to do something about the environment.

P: Okay great. Yes?

S: ...If you talk about the solutions of it, like I think most of the students would be like oh they have the solutions.

P: Exactly and the whole situation is sorted so I don't need to do anything. So that's what, you think it's important to have both.

S: Yeah

P: Impacts and solutions yes. Okay great, I mean I think we've almost covered everything really. That was quite, that was okay. Do you have anything to add and if not then I'll finish? That was really interesting, I agree with you I think we should be looking at both but most people just look at the impacts, that's what only the studies show. Okay thank you for your time, and end.

#### **10.13.4 (A3.4) Network international School, Yangon – 23<sup>rd</sup> March 2017**

P: Okay this is Network International School in Yangon Myanmar, well thank you for joining me guys. Okay, now I have given you a list of questions and the first one is: How interested were you in climate change before this presentation? Were you interested at all and if you weren't, why and if you were why? Does someone want to go first? Yes?

S: Well in my class, we were learning a lot about climate change in the rainforests and tundra regions in geography as well as in eco-club, so I was pretty interested before.

P: So you've been learning a lot about it in school in different forms, that's really interesting. Okay great, someone else?

S: To be honest, I wasn't really interested in this because I wasn't thinking of this at first.

P: Okay, yeah so is that because you don't know much about it, have you not learned...

S: We did it in geography but I forgot all about it.

P: Okay, yeah. Next yeah, do you want to go?

S: Err no

P: No?

S: Okay sure, I'm not really interested

P: Yep... and why is that?

S: I'm not really the kind of guy who gets interested easily in how do you say, climate change, science stuff

P: Okay, is there someone else? Yeah

S: Before this presentation I'm not interested, but after this presentation I'm interested because I learned new facts about climate change

P: So after the presentation you were because you knew more about it?

S: Yeah

P: Okay. Yeah...

S: Before this presentation I wasn't quite interested so my parents used to talk about it and whenever they were talking about it I didn't like it so I would walk away. But then after this presentation I feel more, I am more interested in it.

P: What would your parents say?

S: They were like, because like in our country it will be more hotter and then they will be like, oh this is, this is because of climate change.

P: Now that's very interesting so you're from somewhere which will be very impacted potentially so that's why you're interested in it, that's why your parents have more of an interest in it. That's correct? Yeah?

S: ...

P: Okay, so do you feel anxious at all about climate change? Do you feel worried at all? Has that presentation about the impacts and what could happen, has that made you feel worried about it or not?

S: Yes (in unison)

P: It has, and that's all of you?

S: Yes

P: And why is that?

S: Because it will affect our future

P: Yeah

S: Because the world might end because of this... okay it won't totally end but we are already destroying it and if we don't stop it now it's going to get worse.

P: Yeah you're right. Remember the world won't end but the human society as we know it might end. But the world will be fine; the world will carry on even without us. Okay, so do you feel optimistic? Do you feel , oh because what you were saying earlier about... oh no sorry, we'll come to

that. Anymore about feeling anxious, a bit worried about it and why? And if you don't feel worried about it then why?

S: I think we're worried

S: Not for me

S: Or me

P: Yeah, but why is that? Apart from your futures might change, why? Is there anything in particular that you're worried about?

S: Because I hear on the news all about these droughts and how they're happening.

P: And then have you ever heard anything about the solutions, about the, maybe something positive about climate change, about things that we can do to sort it out? Have you ever heard anything about that in the media?

S: Not really, I mean I don't really listen to radio.

S: No (in unison)

S: Actually I never listen to it

P: Okay and then, do you feel that an individual can make a difference on reducing the effects of climate change? Now you were talking about that with Brody, with Miss teacher...

S: Yes

P: What were you saying about it? Or teacher (laughter). What were you saying about that? You were saying that you don't think you can make a difference?

S: Yes

P: And why is that?

S: It takes time, you need like a good speech so people will be like oh this guy has a good speech, we'll support him.

P: Was it a good speech?

S: For me it won't end well. I'm not going to do that

P: No but I mean even after the presentation you still don't feel like an individual can make a difference? If I had come into the school and I had spoken purely about the solutions, about renewable energy and about growing trees, do you think that would have made you more likely to want to make a difference?

S: Yes (in unison)

P: You do? So if I had been more positive, but you know in quotation marks, you think that would have made you more likely to go and learn about climate change?

S: Yeah but still there is some people who don't care even though, even though If you like say positive things and if you say like let's do this, they won't care. Some people don't care about anything. And there are some people who...

P: Yeah of course

S: It's good to know the impacts that climate change has because then we don't know what we are trying to fix, we just focus on how to fix it.

P: Exactly so you all agree that you should be looking at impacts and solutions?

S: Yeah (in unison)

P: So both should be involved. Okay does anyone else want to say anything at all?

S: No

P: Nope, is it because you are hungry?

S: Yeah

P: Okay, okay thank you very much. Let me just finish... so thank you very much guys and that is the end of the session.

### **10.13.5 (A3.5) Kota Kinabalu International School – 29<sup>th</sup> March 2017**

P: Okay good afternoon, we are at the Kota Kinabalu International School and the date is the 20<sup>th</sup> March 2017. We have 6 wonderful students in front of me, thank you for your time guys.

S: You're welcome

P: Thank you! So the first question is: How interested were you in climate change before this presentation? Did you even know anything about climate change? Someone want to just put their hand up and go first? Yes sir...

S: I didn't know that much before the presentation but...

P: Has this presentation made you more interested? Has it made you...

S: Yeah

P: Yep okay, who wants to carry on, give their own point of view? Someone else want to go next? Yes

S: Well I learned about climate change in school and the presentation added more like to that.

P: Fantastic, so what about the solutions part, is that something that you have looked at before or is that quite a new thing?

S: Yeah

P: It is? So what part of the solutions have you looked at before in class?

S: We could like re-use, like use more renewable resources instead of using the power that does contribute to global warming, we could use water hydraulic electric power and stuff like that.

P: And what about in Malaysia, do you know of any renewable projects that are happening in Malaysia right now?

S: So they sell solar

P: Solar

S: Yeah they, I think near the hospital there is a company which sells solar powers

P: Okay that's very interesting to know. So did this presentation make you more interested and willing to learn about the topic and to change your behaviour and others? It's kind of a yes or no question and if you're not sure that's fine as well. Yes...

S: Yeah

P: It did, and why? Why did it make you more interested and change your behaviour?

S: Erm...

P: That's okay, that's fine

S: Yes it made me more interested in climate change because I didn't know like the climate change was due to us humans, but now I do so yeah.

P: Okay that's interesting, so do you feel anxious about climate change or do you feel more optimistic? Now you learnt about the solutions today, quite a positive way of looking at climate change in a way. So would you say you feel more anxious or optimistic about our future?

S: Anxious

P: And why?

S: Because it's like

P: Okay so it might take a lot of effort for human society to actually change?

S: Yeah

P: Even though I spoke to you about the solutions of it, you still think that it could take a lot of effort? Interesting... Someone else? Yes

S: I think like climate change would happen but we could like make ways to like slow it down

P: So you're feeling a bit more optimistic about the future?

S: Like in-between

P: In-between interesting. So you're kind of like slightly anxious but slightly optimistic as well. But how much of that is because you heard the solutions, maybe something you hadn't heard about in more detail? Do you think that's influenced you at all?

S: Yes (in unison)

P: It has. Anyone want to expand on that? Okay that's okay, we can move on. So do you view it as doom and gloom? Is that how you view climate change? Doom and gloom in English would mean we are all, there are serious problems already there's nothing we can do about it; it's all doom and gloom.

S: No (in unison)

P: That's not how you see it at all?

S: We, in my point of view I see that even though now we are not doing anything but towards the future like in 2 years' time, I think there will be an increase, like more trees. There won't be any more pollution.

P: Okay. Do you have something to say? Yep?

S: If people in the world realise what they have been doing they might, they might like own up to it.

P: So that's an interesting one. Do you think that learning about the impacts is also very important?

S: Yes (in unison)

P: So you don't think it should be just solutions, you think it should be impacts. So do you think it should be both or do you think it should be just impacts? What do you think?

S: Both (in unison)

P: You think both are very important, because the media focuses more on the negative side.

S: Yeah

P: And this is what one of my projects is looking at, it is testing your responses to the solutions. And you've already learnt about it in school which is fantastic. So do you feel that an individual can make a difference on reducing the effects of climate change?

S: Yes (in unison)

P: Do you think that you all can make a difference?

S: Yes (in unison)

P: So why? Why do you think that? Is that something that you have just learned today or is that something you had thought about before and how? Last question, we are almost there. Yes

S: You can go like tell people that that's happening so they realise and can go spread the word

P: So you have had some education today, something that you can tell other people. Fantastic. Yes...

S: If you do more, other people will be inspired to do it as well

P: That leading as an example, so I've come to you today talking about it, you know more and you might tell other people. They'll tell other people... yep. Does anyone have any last things just to say? Any last comments at all? This has been really useful, you might not think it has been but I promise you it has been. No? Okay right that is the end of the recording.



### 10.13.6 (A3.6) International School of Brunei – 6th April 2017

P: This is ISB- International School of Brunei; the time is 2:30pm on 6<sup>th</sup> April 2017. Okay so you've seen the questions, you've had 5 minutes to look through them. So the first question for you is: how interested were you in climate change before this presentation? Does someone want to just start for me? Yes?

S: I think it was, I was interested because we learn this in class a little bit, so I think I was interested but I didn't know much about it so after the presentation I felt like I was more prepared and more informed.

P: Okay. Someone else want to carry on?

S: I think that before the presentation, I don't think climate change was very concerning for me but after the presentation I feel like I know more about it and I feel more interested in climate change now.

P: Excellent. One of you boys want to have a go?

S: I wasn't really interested in it because like ... said I didn't know anything like all I knew was that it was affecting the world and it was to do with pollution. But now I'm a lot more interested in it after the presentation.

P: Okay so what about, did the presentation make you become more interested and willing to learn more about the topic? So do you think that it maybe has changed your view on climate change? Do you feel a bit, how do you feel about it now after the presentation? So we heard about the solutions of climate change, how does that make you feel? Does it make you willing to learn more? One of you boys want to just have a go? It's okay if not. Yes

S: Yeah I became more interested in the topic after the presentation and I think it's a very important thing that is happening to the earth, so yeah...

P: Excellent okay. So how are you, yes?

S: I think that I want to learn more and after hearing the solutions, I feel like we as a school can help and try to solve...

P: So it's made you interested and more willing to learn more about when you heard about the solutions. And do you, how do you feel about it? Do you feel anxious about climate change or do you feel optimistic? Optimistic means positive, much more positive. How do you feel about climate change after hearing about the solutions?

S: I can't think of anything.

P: Okay that's okay

S: I feel anxious because if we knew more about climate change then we could be more aware about the world and what's going on.

P: But are you, do you still feel quite anxious about it? Because we didn't speak about the impacts of climate change, we spoke about the solutions. So how are you feeling?

S: I think it's a bad thing happening to the world because it can affect many things like the weather and the living conditions for people and the animals.

P: Yeah, what about the solutions? We spoke about things we can do to make a difference, so do you feel sort of sad or happy about climate change?

S: I think it's like kind of both because at the start we felt anxious but after hearing all the solutions I felt like more... yeah you could do something about it and yeah

P: So do you think that's more likely to change your behaviours? If I'd spoken to you about the impacts and said the sea-levels are rising, the temperatures are increasing, the ice is melting, the polar bears are dying it's all incredibly depressing, do you think that would have made you become more interested?

S: Yep (in unison)

P: You do? So you think it's best to talk about the impacts and this is what my project is looking at. So you would rather have focused on the impacts and what's going on?

S: Yeah

P: Interesting okay. So do you view climate change as doom and gloom or more as an opportunity for the world to transform itself?

S: A bit of both because if for doom and gloom, we're still quite young so if no one does anything about it that could be the end of the world and then we won't have a future. But it's also an opportunity for everyone to show how responsible they can be and just things like that.

P: But if I had spent the whole time talking about the impacts, do you think you would be feeling a bit more doom and gloom?

S: Yeah (in unison)

P: Do you think that's a good thing?

S: No (in unison)

P: You would rather have focused on, so this is the whole point of the project, do you think that it is important to talk about both the impacts and the solutions?

S: Yeah (in unison)

S: That will make people feel bad about what they're doing and then they'll know how to resolve it.

P: And do you think that an individual can make a difference?

S: Yes (in unison)

P: You do?

S: Because one can start, one can do something then their friends will do it and the friends of their friends and it will all just globally spread.

P: And is there anything that you think you can do individually now, not right now, but I mean in the next couple of weeks, in the next couple of months? Anything that you think you can do? Anything you have thought about which we spoke about or anything at all that could make a small difference?


S: You could like warn family and friends and people can inform more people and eventually it'll like spread across the world and people can do things.

P: Anyone else? Okay, okay fantastic that was very useful. Okay we are now finished ISB, the end.

# 10.14 (A4) Presentation slides



## 10.14.1 (A4.1) Basic Climate Science Prior To Impacts Framing

Slide 1a



### CLIMATE CHANGE & SCIENCE EDUCATION

A FOCUS ON IMPACTS


MAGNIFICENT OCEAN

Slide 2

### WEATHER vs CLIMATE


**WHAT IS WEATHER?**

- Conditions of the atmosphere over a short period of time
- Weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season



**WHAT IS CLIMATE?**

- How the atmosphere "behaves" over relatively long periods of time
- The average weather for a particular region
- Change can take hundreds, thousands or even millions of years



MAGNIFICENT OCEAN

Slide 3

### DEFINITIONS

**CLIMATE CHANGE** Past, present, or future change in climate, with the implication that the predominant, but not exclusive, cause of this change is human in origin

**GLOBAL WARMING** The increase in Earth's average surface temperature due to rising levels of greenhouse gases.

MAGNIFICENT OCEAN

Slide 4

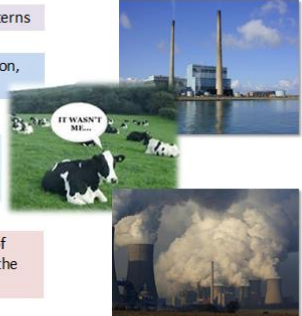
### WHAT IS CLIMATE CHANGE?

A change in global or regional climate patterns

Major changes in temperature, precipitation, wind patterns etc.

In particular a change that is apparent from the mid to late 19th century onwards

Attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

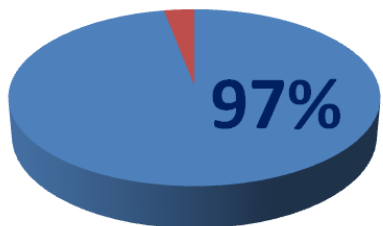


MAGNIFICENT OCEAN

Slide 5

### GLOBAL SCIENTIFIC CONSENSUS

WHAT % OF CLIMATE SCIENTISTS AGREE THAT CURRENT GLOBAL CLIMATE CHANGE IS MAINLY BEING CAUSED BY HUMAN FACTORS?

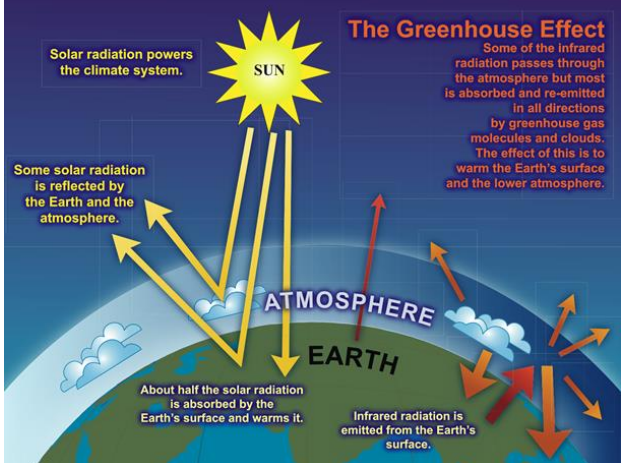


■ Scientists agree  
■ Scientists disagree

MAGNIFICENT OCEAN

Slide 6

### The Greenhouse Effect



Solar radiation powers the climate system.

**SUN**

Some solar radiation is reflected by the Earth and the atmosphere.

ATMOSPHERE

**EARTH**

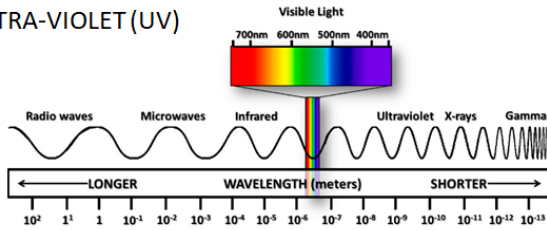
About half the solar radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.

**The Greenhouse Effect**  
Some of the infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.

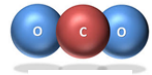
## RADIATION

- INFRARED (IR)
- VISIBLE
- ULTRA-VIOLET (UV)



## MAIN GREENHOUSE GASES (GHGs)

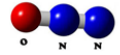
Carbon Dioxide (CO<sub>2</sub>)



Methane (CH<sub>4</sub>)



Nitrous Oxide (N<sub>2</sub>O)

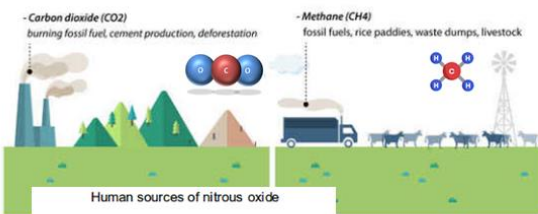


They all absorb radiation and prevent it from escaping out of the atmosphere

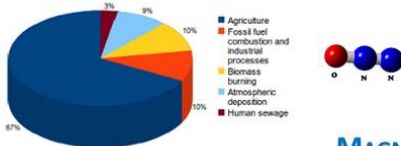
GETTING THE RIGHT BALANCE



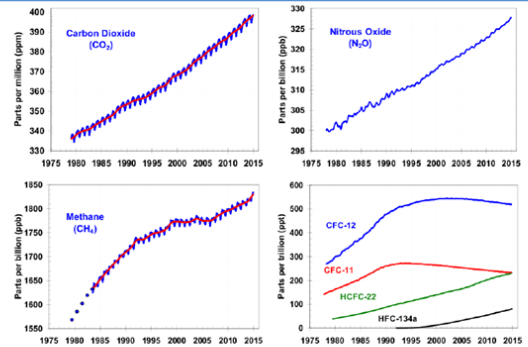
## SOURCES



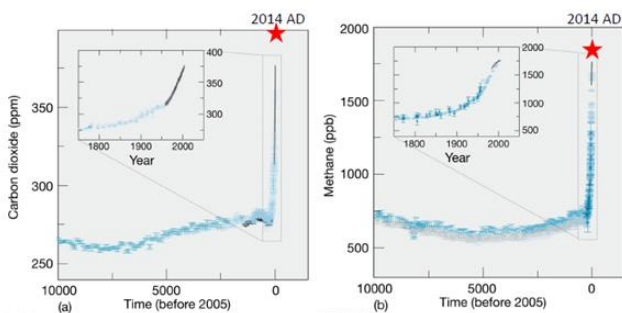
Human sources of nitrous oxide



## GREENHOUSE GAS LEVELS 40 years



## GREENHOUSE GAS LEVELS 10,000 years



## COMMON MISCONCEPTIONS

"Global warming is caused by the ozone hole because the hole lets in more radiation".



"Scientists disagree about whether humans are causing the Earth's climate to change".



"Weather anomalies can be used as evidence for or against climate change".



## 10.14.2 (A4.2) Impacts Framing

Slide 13a

### IMPACTS OF CLIMATE CHANGE



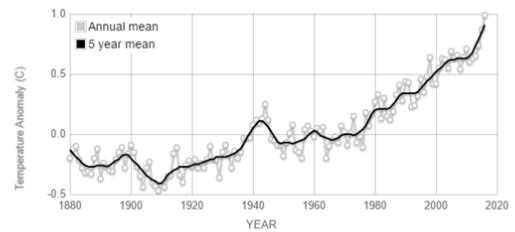
Slide 14a

### IMPACTS OF CLIMATE CHANGE

Increase of 1 degree Celsius – 2016 the warmest year on record

#### GLOBAL LAND-OCEAN TEMPERATURE INDEX

Data source: NASA's Goddard Institute for Space Studies (GISS)  
Credit: NASA/GISS



Slide 15a

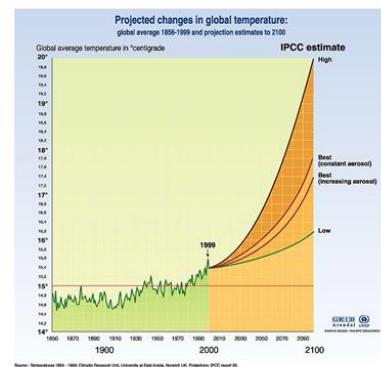
### IMPACTS OF CLIMATE CHANGE

Drought, conflict, poverty, migration

Slide 16a

### IMPACTS OF CLIMATE CHANGE

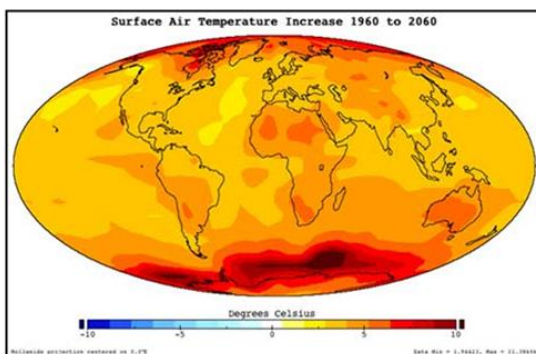
Projected change in global temperature



Slide 17a

### IMPACTS OF CLIMATE CHANGE

Surface Air Temperature Increase



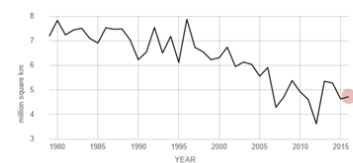
Slide 18a

### IMPACTS OF CLIMATE CHANGE

- Antarctica – holds 90% of the world's ice
- Arctic – rapid decline in ice cover
- Satellite data available since 1979
- Albedo change

AVERAGE SEPTEMBER EXTENT  
Data source: Satellite observations. Credit: NSIDC/NASA  
RATE OF CHANGE  
↓ 13.3 percent per decade

Arctic:





Slide 19a

**IMPACTS OF CLIMATE CHANGE**

ICE EXTENT

Arctic sea ice could disappear even if world achieves climate target

Goal of limiting rise in average global temperatures to below 2C may not prevent ice-free Arctic, scientists warn

Most popular: Visit Kubli's lips into Steve Smith and Australia following second Test incident; George Michael died of natural causes, coroner says

Extreme Weather: Antarctic sea ice reaches record low

Slide 20a

**IMPACTS OF CLIMATE CHANGE**

SEA LEVEL

- Added water from melting land ice
- Thermal expansion of sea water as it warms

Figure 1. Global Average Absolute Sea Level Change, 1880-2015

Slide 21a

**IMPACTS OF CLIMATE CHANGE**

SEA LEVEL

Sea levels could rise by six to nine metres over time, new study warns

Evidence that continental ice sheets are sensitive to slight temperature suggests ocean levels will continue to rise

**Venice could DISAPPEAR within 100 years: Global sea level rise may sink the Italian city, warn experts**

- The Mediterranean will rise by up to 5ft (140cm) before 2100, scientists warned
- Venice and much of Italy's north Adriatic coastline will be swallowed by water
- The predicted rise in sea levels can be explained by global warming

By SASHY DUNNE FOR MAILONLINE  
PUBLISHED: 10:21 GMT, 8 March 2017 | UPDATED: 10:41 GMT, 8 March 2017

94 shares | 243 comments

It may be known as 'The Floating City', but experts have warned that Venice could sink in as little as 100 years thanks to climate change.

They say that Venice and much of Italy's Adriatic coastline is at risk of disappearing all together as sea levels continue to rise.

The Mediterranean will rise by up to five feet (140cm) before 2100, according to scientists from Italy and France.

Slide 22a

**IMPACTS OF CLIMATE CHANGE**

OCEAN ACIDIFICATION

- Decreasing pH of world's oceans – more acidic
- Carbonic acid - Coral bleaching
- 50% of GHG's released are absorbed by world's oceans

Slide 23a

**IMPACTS OF CLIMATE CHANGE**

OCEAN ACIDIFICATION

Rate of ocean acidification due to carbon emissions is at highest for 300m years

Overfishing and pollution are part of the problem; mass extinction of species may be inevitable

**NEWS**

Climate change: State of the Environment report highlights threat of coal mining, urban growth

By political reporter Henry Sides  
Updated: 10:00am AEST 08/03/17

The Government has no comprehensive national plan to protect Australia's landscape to the year 2050, according to a report, which also warns of the potentially irreversible impact of climate change and the threats of coal mining, invasive species, rubbish, urban growth and habitat destruction.

The State of the Environment report — commissioned by the Federal Government and written by independent experts — found while the main environmental challenges remained climate change and land use, Australia had made good progress in managing marine environments.

Slide 24a

**IMPACTS OF CLIMATE CHANGE**

DEFORESTATION

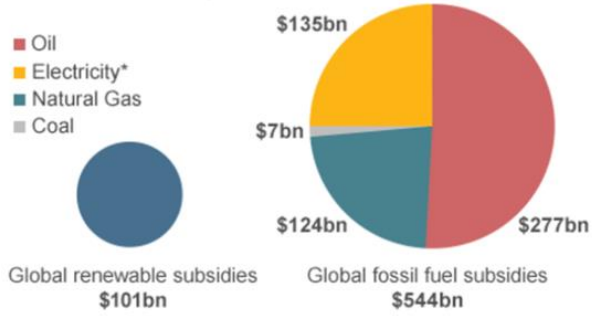
- Amazon rainforest - 17% lost in the last 50 years, mostly for cattle ranching.
- 15% of all greenhouse gas emissions are the result of deforestation - carbon release
- 48 football fields worth of rainforest are lost every minute

**MAP OF DEFORESTATION FRONTS**

Slide 25a

# FOSSIL FUEL SUBSIDIES

Global fuel subsidies, 2012



Slide 26a

# IMPACTS OF CLIMATE CHANGE



Slide 27a

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**Your flight:**  
From: Kobenhavn (DK), CPH to: Kuala Lumpur (MY), KUL via: IST, Istanbul [Ataturk/Yesilkov International Airport], Turkey, TR, Roundtrip, Economy Class, ca. 20,700 km, 1 traveler

CO<sub>2</sub> amount: 4.0 t

Support international projects and sustainable development worldwide:

Compensation in climate projects in developing and newly industrialising countries.

CHF 113.00

Slide 28a

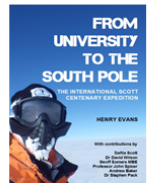


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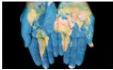


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# 10.14.3 (A4.3) Basic Climate Science Prior To Solutions Framing

Slide 1b

## CLIMATE CHANGE & SCIENCE EDUCATION

### A FOCUS ON SOLUTIONS


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Slide 2

## WEATHER vs CLIMATE


**WHAT IS WEATHER?**

- Conditions of the atmosphere over a short period of time
- Weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season



**WHAT IS CLIMATE?**

- How the atmosphere "behaves" over relatively long periods of time
- The average weather for a particular region
- Change can take hundreds, thousands or even millions of years



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Slide 3

## DEFINITIONS

**CLIMATE CHANGE** Past, present, or future change in climate, with the implication that the predominant, but not exclusive, cause of this change is human in origin

**GLOBAL WARMING** The increase in Earth's average surface temperature due to rising levels of greenhouse gases.

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Slide 4




## WHAT IS CLIMATE CHANGE?

A change in global or regional climate patterns

Major changes in temperature, precipitation, wind patterns etc.

In particular a change that is apparent from the mid to late 19th century onwards

Attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

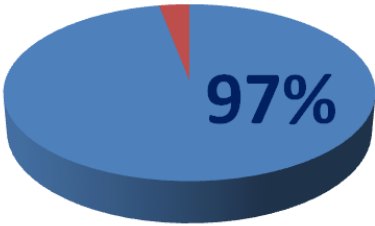




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Slide 5

## GLOBAL SCIENTIFIC CONSENSUS

WHAT % OF CLIMATE SCIENTISTS AGREE THAT CURRENT GLOBAL CLIMATE CHANGE IS MAINLY BEING CAUSED BY HUMAN FACTORS?

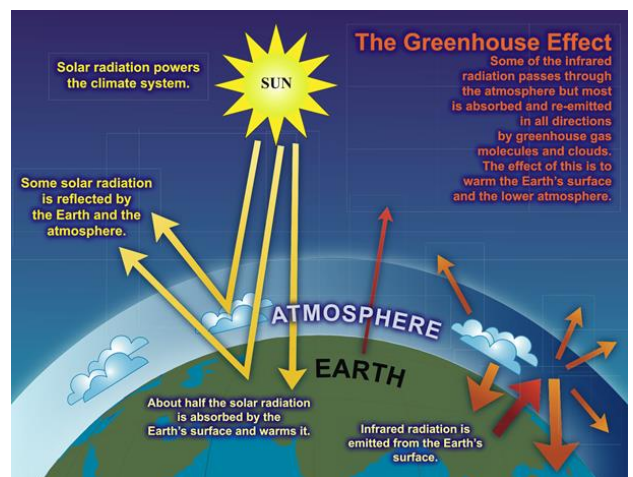


**97%**

- Scientists agree
- Scientists disagree

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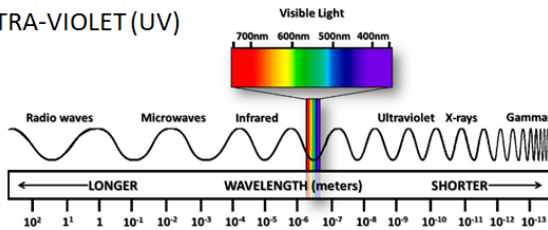
Slide 6



Slide 7

**RADIATION**

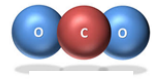
- INFRARED (IR)
- VISIBLE
- ULTRA-VIOLET (UV)



Slide 8

**MAIN GREENHOUSE GASES (GHGs)**

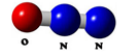
Carbon Dioxide (CO<sub>2</sub>)



Methane (CH<sub>4</sub>)



Nitrous Oxide (N<sub>2</sub>O)



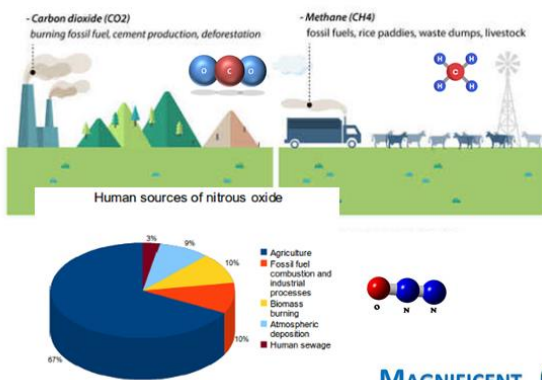
They all absorb radiation and prevent it from escaping out of the atmosphere

GETTING THE RIGHT BALANCE



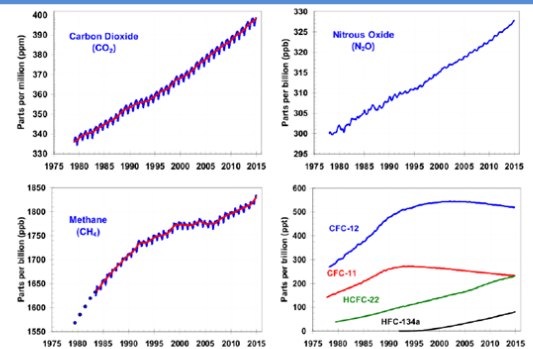
Slide 9

**SOURCES**



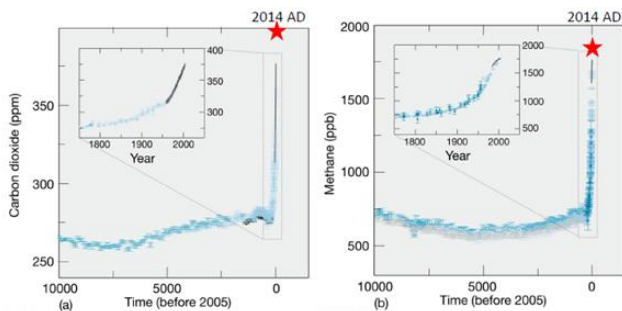
Slide 10

**GREENHOUSE GAS LEVELS 40 years**



Slide 11

**GREENHOUSE GAS LEVELS 10,000 years**



Slide 12

**COMMON MISCONCEPTIONS**

“Global warming is caused by the ozone hole because the hole lets in more radiation”.



“Scientists disagree about whether humans are causing the Earth’s climate to change”.



“Weather anomalies can be used as evidence for or against climate change”.



## 10.14.4 (A4.4) Solutions Framing

Slide 13b

### SOLUTIONS OF CLIMATE CHANGE



Slide 14b

### CLIMATE CHANGE SOLUTIONS

M I T I G A T I O N

Reducing the impacts of climate change

Refers to efforts to reduce or prevent emission of greenhouse gases

1. Using new technologies and renewable energies
2. Making older equipment more energy efficient
3. Changing management practices
4. Changing consumer behaviour

Slide 15b

### CLIMATE CHANGE SOLUTIONS

R E N E W A B L E S

Energy that is collected from renewable resources

Naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.



Slide 16b

### CLIMATE CHANGE SOLUTIONS

R E N E W A B L E S

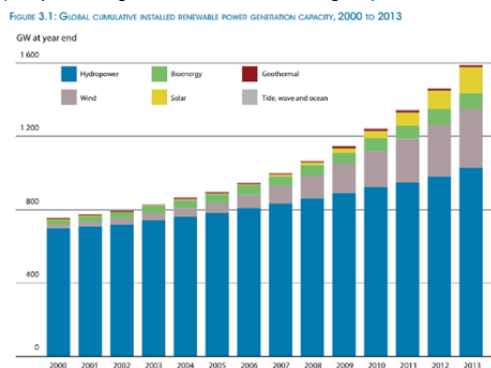


Slide 17b

### CLIMATE CHANGE SOLUTIONS

R E N E W A B L E S

- Price reducing
- Investment increasing
- Capacity increasing
- Storage improvements

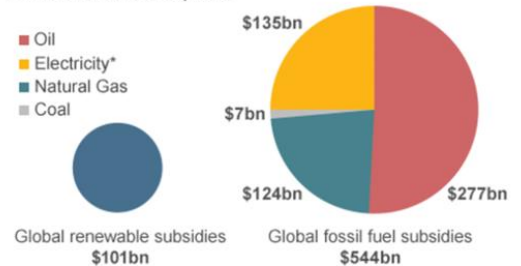


Slide 18b

### Renewable subsidies

R E N E W A B L E S

Global fuel subsidies, 2012



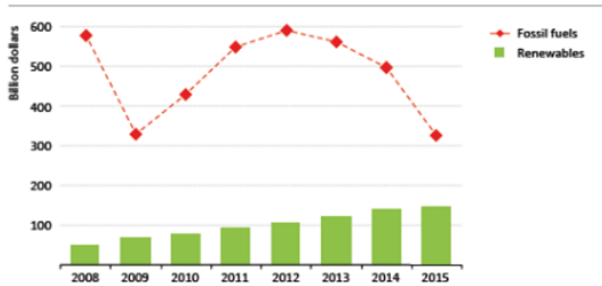


Slide 19b

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## Renewable subsidies

Figure 2.21 ▶ Estimates for global fossil-fuel consumption subsidies and subsidies for renewables

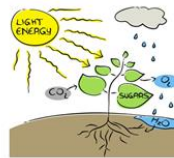


Slide 20b

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## Reforestation

- Projects worldwide
- Photosynthesis



- Conserve habitat for endangered and threatened species
- Improve local water quality
- Retain top soil and control erosion

Slide 21b

NATIONAL GEOGRAPHIC | LATEST STORIES | PHOTO OF THE DAY | GENDER REVOLUTION

PEOPLE V. CLIMATE CHANGE

### Teenager Is on Track to Plant a Trillion Trees

Starting his project as a nine-year-old, Felix Finkbeiner aims to restore the world's forests.

Social media sharing icons: Comment, Facebook, Twitter, Pinterest, and a plus sign for more options.

Slide 22b

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## Politics

Education → Public pressure → Policy change

### Paris Agreement in 2015

- To limit temperature increase to 2 degrees Celsius
- Agreed and signed by 194 different countries (as of 17<sup>th</sup> February 2017)



Slide 23b

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## Technology

Technology improvement, e.g. Tesla solar tiles, electric cars



Slide 24b

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## Co-benefits of mitigation

- Reduce the global impacts of climate change
- Better air quality
- Improved global health
- More equal society
- Job opportunities
- Moral & caring society

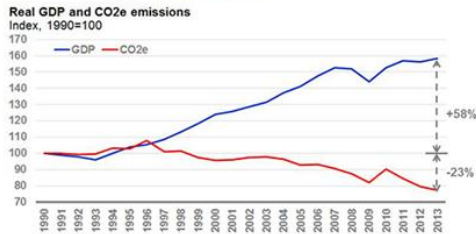
Slide 25b

DECOUPLING

## Decoupling the global economy

GDP increasing and CO2 emissions decreasing

### Real GDP and CO<sub>2</sub>e Emissions in Sweden, 1990-2013



CO<sub>2</sub>e = approximately 80% of CO<sub>2</sub> emissions

Sources: Swedish Environmental Protection Agency, Statistics Sweden

Slide 26b

GLOBALLY RESPONSIBLE

## Globally responsible

- We are all globally responsible for our actions
- We all live on the same planet and breath the same air.
- Electric car? Locally produced food? Perhaps slightly more expensive? But creates a good environmental feeling
- Reducing carbon footprint – everyone can make a difference

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## SOLUTIONS OF CLIMATE CHANGE



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Your flight:  
From: Kobenhavn (DK), CPH to: Kuala Lumpur (MY), KUL via: IST, Istanbul [Ataturk/Yesilkov International Airport], Turkey, TR, Roundtrip, Economy Class, ca. 20,700 km, 1 traveler

CO<sub>2</sub> amount: 4.0 t

Support international projects and sustainable development worldwide:

Compensation in climate projects in developing and newly industrialising countries.

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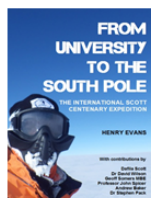
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