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Internationalization of the curriculum through student-led climate change teaching activity

Helen V. McGregor
University of Wollongong, mcgregor@uow.edu.au

Beth O'Shea
University of San Diego

Christine J. Brewer
University of Wollongong, chrisfa@uow.edu.au

Pamela A. Abuodha
University of Wollongong, pabuodha@uow.edu.au

Emma Pharo
University of Tasmania, emma.pharo@utas.edu.au

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Abstract
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Helen V. McGregor [a*], Beth O'Shea [b], Chris Brewer [c], Pamela Abuodha [a], Emma J. Pharo [d]

[a] School of Earth and Environmental Sciences, University of Wollongong, NSW, Australia

[b] Department of Marine Science and Environmental Studies, University of San Diego, San Diego, CA, United States of America

[c] Centre for Education Development, Innovation and Recognition, Northfields Avenue, University of Wollongong, NSW, Australia

[d] School of Land and Food, University of Tasmania, Hobart, Australia

*Corresponding author: H.V. McGregor, School of Earth and Environmental Sciences, Northfields Avenue, University of Wollongong, NSW 2522, Australia. Email: mcgregor@uni-bremen.de Telephone: +61 2 4221 4265, Fax: +61 2 4221 4250

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ABSTRACT

Internationalization of the curriculum is important in today's globalized environment, with the increasingly interdisciplinary nature of complex issues, such as climate change, requiring students to think beyond their disciplinary and cultural boundaries. Here we introduce a novel cross-discipline and cross-country activity with the overall goal to expose students to an international environmental problem (climate change) that requires an awareness of different perspectives, so as to contribute to their development of responsible global citizenship through internationalization of the curriculum. Students studying in Australia and the United States of America completed an anonymous survey on their climate change perceptions, and then the students discussed the results via a live video link. The survey results provided the catalyst for students to reflect on the ecological impact of their different lifestyles. The students could demonstrate their critical thinking skills and develop cross disciplinary thinking by exploring the vexed issue of climate change science, perceptions, and culture. Overall, the survey was simple to implement, the tutorial was successful despite the different time zones. Our activity achieved the broader goal of facilitating internationalization of student learning and enhanced our students' ability to view problems from different angles and helped foster boundary-crossing skills.

Keywords: Curriculum internationalization, climate change perceptions, globalization, student-led learning

INTRODUCTION

Colleges and universities recognize the need to educate their students to be global citizens (Parker et al., 1999; Nussbaum, 2002), since many of society's most pressing issues transcend national boundaries (Falk, 1993; Parker et al., 1999; Kirkwood, 2001; Walker, 2006). Kevin Hovland, the director of global learning and curricular change at the Association of American Colleges and Universities posits that global learning should enable all students "to approach the world's challenges and opportunities from multiple perspectives and to wrestle with the ethical implications of differential power and privilege" (Hovland, 2009). As Nussbaum (2002) suggests, students should have the "ability to criticize one's own traditions"; be able to "think as a citizen of the whole world, not just some local region or group"; and be able to "imagine what it would be like to be in the position of someone very different from oneself".

Climate change is one such issue requiring students to think as global citizens, and research shows that learning to cross cultural and discipline boundaries equips students with the skills to tackle this and other complex problems in the environmental sciences (Bouwen and Taillieu, 2004; Spelt et al., 2009; Bangay and Blum, 2010; Burandt and Barth, 2010; Fortuin and Bush, 2010). Furthermore, meaningful engagement with the issue of climate change requires skills in understanding interdependencies and uncertainty in socio-ecological systems, and an ability to think in an "anticipatory and cross-linked way" (Burandt and Barth, 2010).

Despite the recognition of its importance, the teaching and learning of boundary-crossing skills is still in its infancy (Spelt et al., 2009). These boundary-crossing skills require students to "change perspective, to synthesize knowledge of different disciplines, and to cope with complexity"

(Spelt et al., 2009), and equip graduates to respond to a rapidly changing and diverse world (Bangay and Blum, 2010). The ability to change perspectives and look at problems from different angles may not naturally develop (Fortuin and Bush, 2010) but can be facilitated through internationalization of education and exposure to cultural diversity. Internationalization of the curriculum is "the incorporation of an international and intercultural dimension into the teaching and learning processes, support services and content of a program, course or unit of study to engage students with cultural and linguistic diversity and purposefully develop their international and intercultural perspectives as professionals and citizens within a campus culture that recognizes and values cultural diversity" (Leask, 2007, p.206). Colleges and universities are uniquely situated to provide a comparative perspective whereby graduates know enough about other nations and cultures to make sound decisions involving cross border issues (Bok, 2007).

In this paper we outline a survey and tutorial that brings together internationalization and boundary-crossing skills, allowing students from different cultures and countries to explore the vexed issue of climate change science perceptions. There is broad interest in understanding perceptions of climate change because research shows that public opinion (Leiserowitz et al., 2013; Head et al., In press) can be quite skewed compared with the understanding of climate researchers (Doran and Zimmerman, 2009; Anderegg et al., 2010; Cook et al., 2013). USA young adults have similar beliefs to the general population that climate change is occurring and that humans are responsible (Feldman et al., 2010). Reasons for differing perceptions amongst the general public include the 'creeping' nature of climate change, poor communication of the complexities and uncertainties, a lack of trust, negative portrayal of climate science in the media, and perceptions of risk (Moser and Dilling, 2004; Leiserowitz, 2005; Tollefson, 2010;

Hmielowski et al., In press). An emerging thought relevant to this study is that cultural perspectives and personal experience also shape societal attitudes towards the issue of climate change (Editorial, 2010; Kahan, 2010; Ding et al., 2011; Myers et al., 2013), making the complicated climate change topic suitable for a cross-cultural, international exchange in the college curriculum

The survey and tutorial were administered to undergraduate students from two different English-speaking countries: the University of Wollongong, Australia, and the University of San Diego, United States of America. The students completed an anonymous survey on their perceptions of climate change, followed by a calculation of their individual ecological footprint, and then discussed the survey results and the differences between the student cohorts via a live video link.

The goal of the survey/tutorial activity was to expose students to an international environmental problem (climate change) that requires an awareness of different perspectives (e.g., cultural, political, societal) so as to contribute to their development of responsible global citizenship through internationalization of the curriculum. For this reason, we report on the implementation of the activity as a learning exercise, rather than report on the survey finding *per se.* Specifically, this exercise was designed for students to achieve the following desired learning outcomes: 1) to reflect on their own perceptions of climate change, lifestyles and impacts on their 'ecological footprint', 2) to compare and contrast climate change perceptions with students from different countries, and 3) to reflect on broader questions of why there are differences between key stakeholder (e.g., government, public, scientist) views on climate change and how international perspectives might play a role in these differences.

The survey showed notable differences between the climate change perceptions of the student cohorts, and students asked insightful questions of each other during the live video link in order to understand the differences. The survey was simple to implement and has subsequently been rolled out to other classes at both institutions. The live video tutorial was challenging both in terms of timing (18 hour time difference between Australia and the USA) and technology but ultimately provided a platform for students to demonstrate their critical thinking around climate change issues and left an impression on students far beyond the normal lecture experience.

THE PEDAGOGICAL IMPORTANCE OF GLOBAL CITIZENSHIP

The world is getting smaller, brought about by the globalizing effect of information technology (Oblinger, 2001), which allows people in different countries and different time zones to communicate and collaborate with each other. Education should transcend cross-cultural boundaries, and provide an inclusive learning environment from which students can learn and explore their beliefs about their own and other cultures and behaviors. Along with their discipline specific knowledge, students must acquire the “skills, qualities and attitudes needed to make positive, ethical contributions as citizens and professionals to their global, national and local communities” (Leask, 2011 , p8). Internationalization in higher education can integrate an international perspective into teaching, research and/or service functions of a university or college (Knight, 1997).

Although past efforts to achieve internationalization focused on student mobility by bringing international students together on campus (Leask, 2009), adapting a curriculum to be delivered offshore (Leask, 2011) or on student exchange programs (Yang, 2002), there is currently an agenda in most universities to provide opportunities for the "non-mobile majority" (Leask, 2009, p3). Student experiences need not be limited to constraints brought about by geographical location, but can be extended to the global classroom, unrestrained by time or place. According to Oblinger (2001, p62) "what we can see depends to a significant degree on what we have learned to think about, to look for, and to expect". Chickering and Braskamp (2009) suggest a number of strategies to help students develop global perspective including bringing cultural differences into the classroom through pedagogical techniques. As such, in the survey and tutorial outlined in this paper, the students' classroom became a global classroom, giving them the opportunity to liaise with students who, although English speaking, were from a culture different to their own.

METHODS

Participants

The climate change survey and tutorial could be implemented between any classes that include a climate change component. In the example described in this paper it was delivered to first year undergraduate students in 2010 at the University of Wollongong, Australia, (herein AUS) and students ranging from first to fourth year at the University of San Diego, USA (herein USA). Note that although we use the USA/AUS abbreviations our students are not necessarily representative of all students in the respective countries.

AUS students were enrolled in the introductory first year Science Faculty subject 'Climate Change', which covers the climate system, effects of humans on climate, climate change impact, mitigation and adaptation. The course has run since 2009, and in 2010 there were 83 students enrolled in the subject (83% Australian; 45% female, 55% male; 57% 18-20 years old (yo), 38% 21-30 yo; Table 1). There are no pre-requisites for the course and it is open to students from any Faculty across the University, however approximately 85% of the students declared an intended science major. In addition to participating in the joint survey, the 2010 AUS cohort also participated in a joint activity with 3rd year Environmental Law, reinforcing the cross-disciplinary nature of climate change (Davison et al., 2012; Pharo et al., 2013; Davison et al., 2014) and its selection as the topic to assess awareness of student global citizenship.

The USA students (2010: 97% American; 76% female, 24% male; 45% 15-20 yo, 55% 21-30 yo; Table 1) were enrolled in 'Introduction to Earth Systems', a 100-level introductory course offered by rotating geology professors from the Department of Marine Science and Environmental Studies. The course has no pre-requisites and serves both science majors (48% in 2010) and non-science majors (52% in 2010), with the latter fulfilling either a physical science requirement for humanities, business, and economics majors, or a liberal studies requirement for those obtaining an education credential for high school or elementary teaching. The course explores the interconnectedness of Earth's spheres and introduces basic geologic principles such as plate tectonics, rocks and minerals, and geologic time. Climate change concepts are covered in

a 3-4 week series of lectures explaining global climate, Earth's energy balance, paleoclimatology and anthropogenic climate change.

Procedure

AUS students were given the survey in the first week of class and completed it online using eLearning software. USA students completed the survey in written form midway through the semester before the 3-4 week climate change unit. This discrepancy in timing was planned so that both cohorts received the survey prior to significant exposure to climate change curriculum. The survey (Appendix I) was split into two parts. In Part I, students were surveyed for demographic information, and on their perceptions on climate change. There were 16 questions in Part I, and several (5 out of the total 19) questions were taken directly from surveys in published studies (European Comission, 2008; Doran and Zimmerman, 2009). These questions were used to allow possibility for comparison of attitude between the students' and different sectors of the population and provided additional international perspectives by reporting results from European surveys. Part I of the survey took approximately 15 minutes to complete.

After completing Part 1 of the survey, students were then asked to calculate their 'ecological footprint' using an online calculator (EPA Victoria, 2010a). The Personal Ecological Footprint Calculator (EPA Victoria, 2010a) calculates how much productive land is required to maintain a given individual's lifestyle, taking into account the level of consumption, energy usage, and waste generated in a given year, assuming current technology (EPA Victoria, 2005). Results are given in 1) 'Number of Earths' required to provide the resources if every person on the planet

lived that individual's lifestyle, 2) global hectares of productive land used to sustain that individual's lifestyle, 3) an estimate of the tons of carbon (CO_2) emitted as a result of the individual's lifestyle, and 4) a pie chart of the factors contributing to the individual's ecological footprint.

The EPA Victoria's Ecological Footprint Calculator was chosen because it asked questions about a wide range of possible sources of CO_2 that may contribute to a person's emissions, measures a wider range of environmental impacts than just greenhouse gas emissions, and had an appealing interface. The EPA Victoria's Ecological Footprint is also aligned with the international Ecological Footprint Standards adopted in 2006 to ensure the credibility and consistency of footprint studies (Global Footprint Network, 2009, 2010). For consistency, both cohorts of students used this Ecological Footprint Calculator. Students took on average 30 minutes to calculate their footprint and were encouraged to bring along electricity bills to make the survey as accurate as possible.

Part II of the survey consisted of two questions. Students were asked to enter the 'Number of Earths' that would be needed if every person on the planet had their lifestyle. This metric was calculated as part of the ecological footprint output. An additional question asked "Which group of students they thought would have the higher ecological footprint, students from Australia or USA?" Part II of the survey was completed in approximately five minutes.

Twelve weeks after the AUS students completed the survey, and one week after the USA students finished the survey the students met via *Skype* to discuss the survey results and the similarities and differences between the two student groups. This timing was necessary to accommodate the offsets in semester timing in both countries. For the AUS students participation in the discussion was voluntary. For the USA students participation was compulsory as they were given one class lecture off in lieu of the evening *Skype* discussion. There was an 18-hour time difference between AUS and USA. For the AUS students the activity took place from 1.30-2.30pm, during one of the AUS lecture timeslots, and a light lunch was provided. For the USA students the activity took place from 7:30-8:30pm. Twelve students participated from AUS and 30 students participated from USA. For the AUS students the tutorial was run in the final week of session before exams, which, together with voluntary participation in the tutorial, likely influenced the turnout. To ensure these students were representative of the majority of students in the class (and not solely high caliber students) an analysis of their grades showed that of the 12 AUS students who did participate, they report a slightly higher mean grade (75 ± 4%; approximately equivalent to US B+) compared to the class average (70 ± 9%; approximately equivalent to US B). The average grade for students in the USA class was a B- (80 ± 15%).

Approximately 30 minutes prior to the *Skype* tutorial USA students were given a graphical summary of the survey results and were asked to prepare questions to ask during the tutorial. Students were divided into groups of approximately five and asked to focus on results that (i) identified climate change as a problem, and (ii) highlighted differences between answers from students in the two countries. Students spent approximately 20 minutes refining their questions and the most interesting questions were selected to be asked during the live *Skype* chat. AUS

students were presented with the same graphical summary as the USA students 10-15 min ahead of the *Skype* tutorial, and were encouraged to devise questions to ask during the tutorial.

The following tutorial agenda was followed:

A. 10-15 minutes opening discussion AUS only
B. Opening
    a. comparison of demographics
C. Discussion - students to ask questions of each other related to
    a. The way they lived
    b. Climate change as a problem
    c. Their ecological footprints
    d. Perceptions of scientific consensus on climate science
D. Final questions and wrap up

OBSERVATIONS AND ASSESSMENT OF LEARNING OUTCOMES

We investigated the validity of our propositions through the four lenses of (Brookfield, 2002): self, student, peer and the literature (Implications and Conclusions section). We provide an analysis of the activity through self-reflection of the activity from the perspective of teachers, through asking peers to evaluate the outcomes of the activity, asking students, and comparing our work with similar scholarship of teaching and learning.

Student responses

At the beginning of the tutorial students were excited and apprehensive about how the joint tutorial would work and what they might learn from each other. The climate change attitude

survey results gave the tutorial a focal point and proved an effective catalyst for discussions. The survey responses for the USA and AUS students (all students) are summarized in Table 1. There were several points of difference amongst the students in terms of demographics (e.g. intended major, gender), lifestyles (e.g. transport to/from campus), ecological footprint, and perceptions and attitudes in relation to climate change. Students were provided with a set of summary handouts drawing their attention to these points of difference.

Students commenced the discussion by asking questions about demographic differences between the cohorts. USA students were interested in the relatively low number of AUS students living on campus (52% USA, 0% AUS students living on campus; Table 1), the relative size of the cities (San Diego and Wollongong) and their proximity to other major metropolitan centers (Los Angeles and Sydney, respectively). A key icebreaker was learning of the different legal drinking ages between the USA and AUS, and helped to open the discussion to international differences. In addition, questions and answers on vegetarianism and food origins, issues directly related to ecological footprints, and curiosity about the perception of each other's culture relaxed the students. More importantly, these opening discussions set the stage for students to begin reflecting on their own lifestyles and how such lifestyles might impact their ecological footprint (learning outcome one), which enabled the discussion to move towards comparing and contrasting each other's attitudes and perceptions towards climate change (learning outcome two). One AUS student asked:

"What do you think is your primary concern about climate change? What do you think will affect you the most?" Rising oceans, loss of reefs and resources featured among the answers.

Another AUS student used her observations of wind farms in the Australian landscape to ask about wind farms and renewable energy usage in California. AUS students appeared surprised to hear that solar and wind energy were commonly used in California highlighting a comparison between the two countries with respect to energy generation but perhaps pointing out a contrast in the perception of the availability and use of such alternative energy. This then lead to a broader discussion of energy generation in each country.

A key aim of the learning outcomes was for students to reflect both on their own perceptions of, and consider any possible international differences in, their ecological footprints. Students were surprised that the USA students had a lower 'Number of Earths' needed to sustain their lifestyle (2.88 USA and 3.37 AUS 'Number of Earths'; Fig. 1) compared to the AUS students, especially since their perceptions of the other culture would have suggested otherwise (63% AUS and 83% USA students thought USA students would have the higher 'Number of Earths'; Table 1 and Fig. 2). The ensuing discussion, triggered by a question from a USA student showed depth, thought and insight: without prompting, students discussed possible flaws in the Footprint Calculator methodology, and possible reasons for the AUS outlier (Fig. 1). Collectively the students determined that the most likely reason for the difference may be from the transport footprint (Fig. 3). The students compared and contrasted their modes of transport to/from university, the duration of their commute, and broader social and financial reasons as to why students were

living further or closer to campus. They then discussed the implications of these choices for their ecological footprint.

To reflect on broader issues of culture and climate change and how differences may influence different stakeholder perspectives (learning outcome three), the students first started with questions focused on the individual perspective:

> "Does your upbringing influence your attitudes to climate change?" USA

And broadened to consider other stakeholder perspectives with students discussing what factors may contribute to the large percentage of the public thinking that human activity is not a significant factor in changing mean global temperatures (Doran and Zimmerman, 2009).

The tutorial concluded with a spontaneous question from an AUS student:

> "If they were going to do one thing individually, what do they think is the most important one thing that they could do to make a difference in regards to climate change?"

This prompted a deeper level of self-reflection from the students, all the more meaningful as it came from peers. Answers ranged from the practical behavioral changes (e.g. recycling, using less energy), to what they could do to influence global solutions (e.g. lobby politicians). The self-reflection was evident weeks later when USA students referred to the activity during fieldwork as part of their course, and the activity prompted a discussion of cultural differences and how that might relate to climate change attitudes. Furthermore, end-of-semester USA student evaluations of the entire course revealed the effectiveness of integrating an international

perspective into the curriculum with students frequently mentioning their enjoyment of this particular part of the course. Hence the activity had a legacy beyond the classroom and appeared to meet the overall goal of the activity to increase globalization in the classroom.

Teachers' responses

O'Shea (USA) and McGregor (AUS) observed similar interest and positive engagement from the AUS and USA students. In particular, O'Shea noted the development of more thoughtful and internationally relevant scientific questions as the discussion proceeded. Initially, student questions lacked focus, for example,

> "Australian students seem to use public transport more, is it more reliable/accessible in Australia?"

> "Since the ozone hole is close to Australia, do you have to wear more sunscreen?"

While these questions were useful for introductory discussions, the students were reminded of the purpose of the survey and the study in general, that is, to gain insights into possible perceptions and cultural differences they have regarding climate change. O'Shea suggested they use the demographic information as supplementary material to find a more focused question. As such, their second attempt at questions thus became more suitable in meeting the learning outcomes. For example,

> "If Australian students generally feel more well informed regarding climate change, are they surprised to see that on average, Australian students have a higher ecological footprint than the American students?" (question indicates that the student is contrasting

the results of the ecological footprint between the two countries, in addition to investigating the perceptions of their own results).

"Are there any government policies in Australia that encourage environmental sustainability?" (question indicates a broadening of the discussion to better understand how key stakeholders might be addressing an international problem such as climate change).

Peer evaluation

Two peers were asked for their evaluation of the exercise, the AUS course co-coordinator and an AUS Learning Designer. They agreed that the exercise had been a positive and engaging experience for students. The AUS co-coordinator of the subject, observed

"Despite the difficulties [with video technology and time zone differences] both the students from AUS and USA were very enthusiastic in communicating with one another and soon it was as if the students had actually met each other before. The students not only asked each other questions related to climate change but also how they found university life and what they do during their free time."

AUS Learning Designer commented

"The body language of the Wollongong Students was very positive. They gave indication that they felt involved, leaning toward the screen, and actively engaging not only with the USA students, but also with each other in response to some of the answers that the

students provided. On exiting the room, one mature aged student commented that the activity had been great fun, and wished that there were more opportunities available to engage in this type of activity."

The AUS Learning Designer recommended that the AUS students have a longer discussion first, similar to the format of the USA, to focus them, and to discuss their own ecological footprints. Group participation in discussion can be one of a range of strategies to increase public understanding of climate science (Center for Research on Environmental Decisions, 2009). An additional suggestion was to have a discussion of key issues of climate change for both groups whereby the AUS and USA students formed mixed groups (though the AUS Learning Designer noted that this would be harder to implement).

SUGGESTIONS AND IMPROVEMENTS FOR IMPLEMENTATION OF THE ACTIVITY

Implementing the climate change survey

The climate change attitude survey is relatively simple to implement logistically, either as a paper-based or electronic survey, however wording of some questions, particularly related to demographic information, may need to be adapted to specific student cohorts. In our case, after conducting the survey in 2010 several questions were revised (Appendix 1 gives the revised survey). For Australian students, an age category of less than 18 years was added as a significant number of students in first year are under this age. This is also helpful for U.S. institutions where Institutional Review Board ('ethics' approval) may be specific to adults 18 years and over.

Question 5, on the student's mode of transport was made more specific. The original wording, "My primary method of travel to university is by…", was ambiguous. The new wording, "My primary method of travel from my home (during the teaching semester) to class is…" (Appendix 1), focuses more on transport to and from campus during the teaching semester. The categories for responses to this question were simplified, and the "live on campus" category was removed.

Three new questions were added to the survey: "The approximate distance between my home (during the teaching semester) and campus is…"; "Fighting climate change can have a positive impact on the economy…"; "In your opinion, would you agree or disagree that there is general scientific agreement on human induced climate change?" (Appendix 1). The revised survey also asked for more information on declared minors, in addition to majors, to better understand the target audience. We would recommend implementing the revised survey.

The survey can be rolled out and adapted in a number of different ways. In 2011 the survey was given to students at the University of Wollongong in five different subjects and covering four different year levels. Students in the classes 'Social and Environmental Accounting' (third year), 'Redefining Eden: Indigenous Peoples and the Environment' (second year), 'Communication and ICT Workplace Practice' (Masters level), 'Fundamentals of Science Communication' (Masters level), and 'Climate Change' (first year) all completed the survey. With student data from multiple disciplines and multiple year levels, it is possible to see discipline-specific differences in student perceptions of climate change. With the survey conducted in 2012 attitudinal differences through time can also be explored. Together, analyzing the survey results themselves can form a student activity, even without interaction with students from another

class. Students can compare their own perceptions of climate change to students in other disciplines and surveys from previous years, reflect on the possible reasons for similarities and differences, and reflect on their own ecological footprints. Furthermore, because a number of the survey questions were taken from surveys of the general public and climate scientists it would be possible for the students to compare their results to results from these other populations.

There is a range of different tools for calculating ecological footprints. The implementation of this activity is not dependent on the choice of Ecological Footprint Calculator, but it is important that all students use the same Calculator. An additional dimension to the task could be to compare the results of different calculators.

Implementing the joint tutorial

The joint tutorial presents some logistical challenges. Issues of time zone differences, technology, and class size must all be considered. Mutually convenient time zones can be planned using simple web tools, such as http://timeanddate.com/worldclock/meeting.html . Dedicated video conferencing facilities would be ideal, allowing a more free flowing discussion, although in this case *Skype* worked quite well. This activity would ideally suit classes of around 30 students, as any more than this number would make the full-class discussion unwieldy. Given that consideration, however, the activity is flexible enough that the discussion part of the tutorial could adopt a different format. For example, students could be broken into smaller groups, paired up between the classes and left to organize their own discussion.

Pedagogically, it was challenging to keep the joint tutorial educationally beneficial. The students were excited to talk to those from another culture. While this fits with the activity's goals of internationalization and cultural exposure, we needed them to focus to ask questions with substance that related directly to the activity goals. Providing the survey results to the students before the tutorial and asking them to devise and hand in possible questions to ask, as was done at USA, is one way to overcome this issue. Dedicated discussion facilitators (in our case McGregor and O'Shea) can also keep the discussion focused.

Metacognition

We also recommend post-tutorial metacognition, either by class discussion, or by a short reflection assignment. Students should reflect on what they found most surprising or unclear, or what new insights they had gained. Students could compare along the lines of "I used to think…/ but now I know…" . Furthermore students could reflect on ways in which the joint tutorial is or isn't a good way to compare student cohorts.

Metacognition is also recommended for instances where the survey alone in implemented. In 2010 and where the survey was given in subsequent years (without tutorial), AUS students were required to compare their carbon footprint to consumption in other Australian demographics (e.g. http://www.acfonline.org.au/sites/default/files/resource/index67.swf), and globally (e.g. http://carbonfootprintofnations.com/), and reflect on the inter-relation of income, consumption, and CO_2 emissions. The students were asked to discuss the main contributions to their ecological footprints, and what can they could do to reduce their footprint. In addition, the students were

asked to form small groups and discuss what they think they know and don't know about climate change; how they know what they know; the points of knowledge similarity and difference between them; how they would resolve the differences and investigating the evidence for/against their differing positions; the difference between 'opinions' and 'facts' in relation to the climate change debate; and, what they think may be reasons for confusion surrounding climate change science. These reflection topics are consistent with the learning outcomes of the surey/joint tutorial, and further could also be focal points for the joint tutorial.

IMPLICATIONS AND OPPORTUNITES FOR FURTHER RESEARCH

Reasons behind the student responses likely extend far beyond simple Australian versus American cultural traditions. For example, Kahan (2010) refers to cultural cognition – the influence of group values on one's beliefs- to explain that the same groups of people who disagree on 'cultural issues', such as abortion and same sex marriage, also disagree on whether climate change is real. While the present study did not aim to investigate such competing moral outlooks, the results provide preliminary thought into possible reasons for student responses. As such, we have included a summary of student responses to the survey in Table 1. The more reflective student may be inspired to critically evaluate reasons for the variety of opposing responses, hopefully leading to a justification of their responses. This can be instrumental to establishing their own sense of identity (or group identity) and is a fundamental component of a student's progression towards developing a global perspective (Chickering and Braskamp, 2009). Our survey could be extended to delve into students' political and personal beliefs and compare these factors with nationality in terms of how well they predict student's responses.

The psychology behind students' responses may be of interest to those in the fields of geoscience cognition or environmental psychology. For example, one of the interesting questions/responses highlighted in the survey results (Table 1) indicates that students in the United States (USA) more strongly recognize that their actions may make a difference to reducing global anthropogenic carbon emissions (question 17), when compared to the responses of the Australian students. This could be linked to broader questions of climate change perceptions, for example the work of Lewandowsky (2011), which showed that when graphs of upward trending temperatures was presented as share prices, people correctly judged the trend, irrespective of their attitude towards climate change.

CONCLUSIONS

The strength of this activity is that it makes use of available technology to bring internationalization to the classroom. Our activity teaches the students to think outside their discipline, encourages multi-disciplinary thought, preparing them to tackle 'tricky' problems and is flexible enough to be adapted to a variety of classroom settings. Consistent with the advice of (Murphy et al., 2005), our activity is constructivist, providing scaffolding for students to make sense of climate change decision-making through active learning.

Overall, the authors perceive that the activity was successful in achieving the learning outcomes and overall goal. Discussion between the two international cohorts successfully identified

similarities and differences in their own (and others') perceptions of climate change, while also noting and reflecting on differences in lifestyle, culture, personal upbringing, and government policy that may influence climate change perceptions at different stakeholder levels. The results of these discussions and reflections indicate that students gain a greater appreciation for the role of globalization in addressing environmental problems. It is thus hoped that by designing a simple activity to internationalize the curriculum, student awareness of different international and cultural perspectives will help contribute to the successful development of responsible global citizens.

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FIGURE CAPTIONS

Figure 1. Comparison of the 'Number of Earths' for AUS (grey) and USA (white) students who participated in the ecological footprint survey. The 'Number of Earths' is a measure of the equivalent resources required if every person on the planet lived that individual's lifestyle (EPA Victoria, 2010b).

Figure 2. Comparison of the student's perception of which student cohort they believed would have the higher 'Number of Earths'. Most students, from either AUS (dark grey) or USA (white) perceived that students from the USA would require a greater 'Number of Earths'.

Figure 3. Comparison of transport method for AUS (grey) and USA (white) students who participated in the ecological footprint survey.

TABLE 1. STUDENT RESPONSES (AUS N=73, USA N=29) TO CLIMATE CHANGE SURVEY. QUESTIONS WITH NOTABLE DIFFERENCES OR INTERESTING RESPONSES ARE SHADED IN GREY.

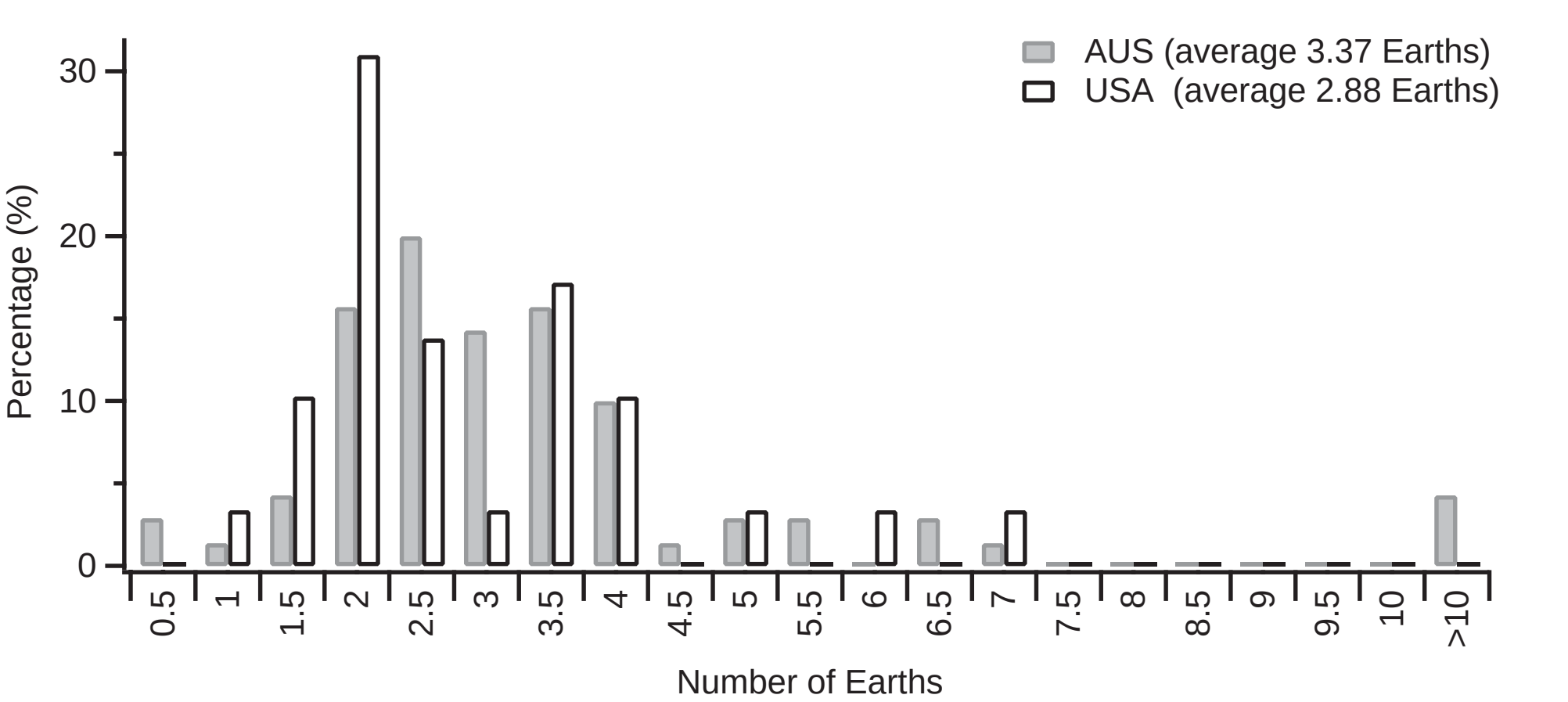
Question Asked	Answers to Choose From	AUS Responses (%)	USA Responses (%)
PART I			
1. My country of residence is	Australia	90	0
	USA	10	97
	Other	0	3
2. My age is	15-20	57	45
	21-30	38	55
	31-40	1	0
	41-50	3	0
	Above 50	0	0
3. I am	Female	45	76
	Male	55	24
4. My intended major is	Science	85	48
	Non-science	14	52
	Didn't answer	1	0
5. My intended minor is	*Did not collate responses*		
6. My primary method of travel to University is by	Car- sole occupant	29	21
	Car – car pool	16	17
	Bicycle	3	0
	Train	9	0
	Bus/tram/trolley	30	3
	Ferry	0	0
	Walk or run	12	7
	Live on campus	0	52
	Didn’t answer	1	0
7. When compared with pre-1800s levels, do you think that mean global temperatures have generally risen, fallen, or remained relatively constant?	Risen	89	83
	Fallen	1	0
	Remained constant	10	17
8. Do you think human activity is a significant contributing factor in changing mean global temperatures?	Agree	90	83
	Disagree	10	17

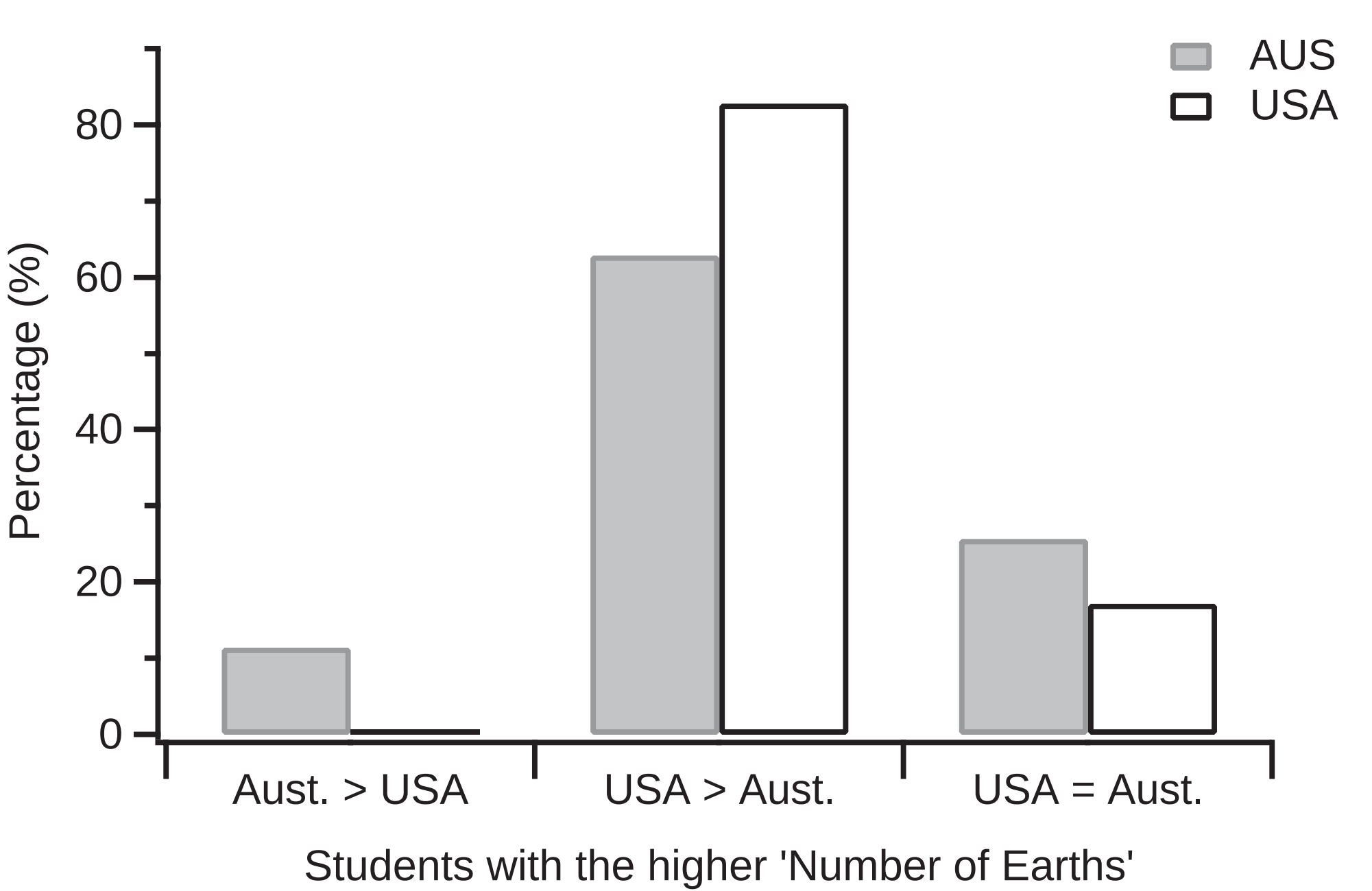
9. Personally, do you think that you are well-informed or not about human induced climate change?	Very well informed Well informed Not very well informed Not at all informed Don't know	3 66 29 1 1	3 52 41 3 0
10. Climate change is an unstoppable process, we cannot do anything about it.	Totally agree Tend to agree Tend to disagree Totally disagree	7 27 52 14	3 35 52 10
11. The seriousness of climate change has been exaggerated.	Totally agree Tend to agree Tend to disagree Totally disagree	3 32 47 19	10 38 45 7
12. Emission of CO_2 (Carbon dioxide) has only a marginal impact on climate change.	Totally agree Tend to agree Tend to disagree Totally disagree	3 22 47 29	3 41 38 17
13. Fighting climate change can have a positive impact on the community.	Totally agree Tend to agree Tend to disagree Totally disagree	45 45 10 0	45 52 3 0
14. How serious a problem do you think climate change is at this moment? *On a scale from 1 to 10, 1 would mean that it is not a serious problem at all and 10 would mean that it is extremely serious.*	1 2 3 4 5 6 7 8 9 10	0 0 3 1 7 20 34 16 6 12	0 0 0 3 14 21 21 31 10 0
15. How serious a problem do you think climate change will be in 50 years' time? *On a scale from 1 to 10, 1 would mean that it is not a serious problem at all and 10 would mean that it is extremely serious.*	1 2 3 4 5 6 7 8 9 10	0 0 0 1 3 1 11 27 29 27	0 0 0 3 0 7 21 17 21 31
16. The media portrays climate change science in a responsible way.	Agree Disagree Don't know	19 58 23	14 59 28

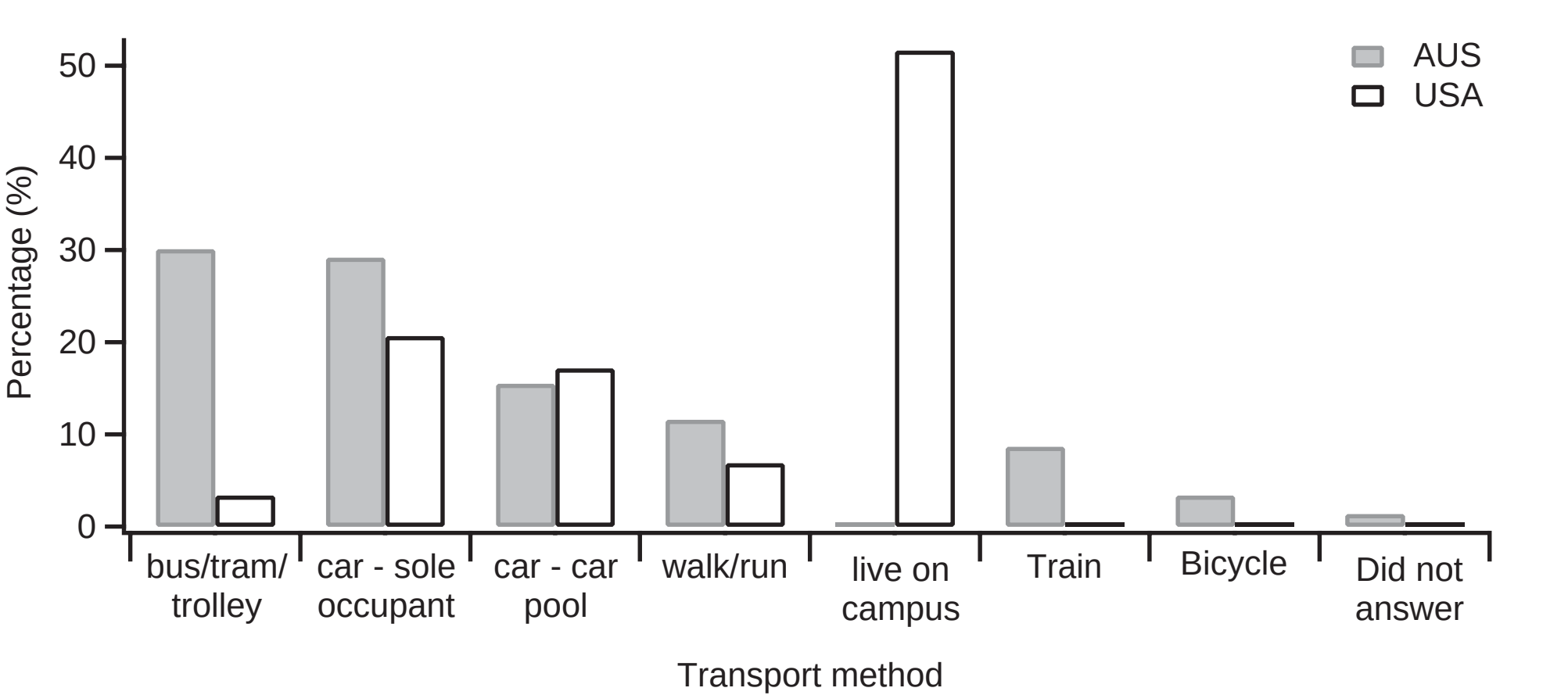
17. My actions can make a difference to reducing global anthropogenic carbon emissions.	Agree Disagree Don't know	78 10 12	97 3 0
PART II			
18. If everyone lived like you, how many planet Earth's would be needed to provide the resources (to the nearest 0.5 Earths)?	0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 >10	3 1 4 16 20 14 16 10 1 3 3 0 3 0 1 0 0 0 0 0 0 4	0 3 10 31 14 3 17 10 0 3 0 3 0 0 0 0 0 0 0 0 0
19. Comparing students, just like yourself, from Australia and the USA, which group of students do you think would have the higher 'Number of Earths'?	Australian students will have a higher carbon footprint than students from the USA Students from the USA will have a higher carbon footprint than Australian students Their carbon footprints will be about the same	11 63 26	0 83 17

648

649


AUS (average 3.37 Earths)
USA (average 2.88 Earths)
Percentage (%)
30
20
10
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
>10
Number of Earths


AUS
USA
80
60
40
20
0
Percentage (%)
Aust. > USA
USA > Aust.
USA = Aust.
Students with the higher 'Number of Earths'


AUS
USA
Percentage (%)
0
10
20
30
40
50
bus/tram/ trolley
car - sole occupant
car - car pool
walk/run
live on campus
Train
Bicycle
Did not answer
Transport method