

Abstract

The current systematic literature review aims to explore attitudes to climate change over the last fifteen years with a particular focus on those studies reporting findings based on gender. Climate change is a global issue that impinges on the lives of all. Despite the plethora of studies devoted to examining public attitudes and opinions to environmental issues, relatively few have explored the potential for gender differences until fairly recently. Given that gender differences are reported throughout mainstream psychological literature, it is feasible that differences will exist in the environmental arena also. Seven databases were utilised to search for peer reviewed and published literature between the period of January 2000 and November 2015, resulting in fourteen studies meeting inclusion criteria. The results indicated that gender differences indeed exist, with women demonstrating significantly more pro-environmental attitudes and behaviours to climate change than men. These findings have meaningful implications for future policy decisions aimed at engaging the public in pro-environmental attitudes and behaviours.

Introduction

There currently exists a diverse multi-disciplinary body of literature devoted to exploring beliefs and attitudes regarding global warming and environmental concerns. Such research has examined these beliefs, opinions and attitudes from a political, societal and individual basis (Berrang-Ford, Ford & Paterson, 2011). Global warming or more specifically climate change is arguably the most serious environmental challenge of the twenty first century (Thuiller, 2007). Within the literature, any attention afforded to potential differences in attitudes and opinions between the sexes has historically been minimal (Van Liere & Dunlap, 1980). Furthermore, any reference to gender within studies has most frequently been noted in the form of statistical controls for multivariate models of analysis (McCright, 2010). Yet, it is well documented in the general psychological domain that differences exist between the sexes, from perceptions of scientific knowledge, to the expression of empathy (Fox & Firebaugh, 1992; Keller, 1985). Given the increasing reporting and awareness of environmental disasters such as the Tsunami in 2004 and the inclusion of 'Education for Sustainable Development and Global Citizenship' (ESDGC) within the mainstream school curriculum, there may emerge important differences between the genders which could contribute to our current understanding of public attitudes to climate change and more specifically, how strategies to engage the public audience in environmentally responsible behaviour, could be developed.

Aims and objectives

The current systematic literature review aims to explore the empirical evidence for public attitudes to climate change over the last fifteen years, with the emphasis on exploring studies which include findings based on gender.

Methods

The search process

A search of peer-reviewed published literature dating from January 2000 - November 2015 was conducted. Seven electronic databases were selected for this purpose, namely: Science Direct, PsychSource, JSTOR, ISI Web of Knowledge, PsycINFO, PsycARTICLES and EBSCOhost. The search criteria included a variety of combinations of the terms reported in table 1, with the use of Boolean operators for optimum search sensitivity. Furthermore, reference lists of included studies were manually checked for additional research deemed to be of relevance.

Table 1 Search terms

Facets	Search terms
Attitudes	Public beliefs, public values, public opinions, public awareness, public views, public perceptions, public concerns.
Climate change	Environmental concerns, environmental values, environmental awareness, environmental issues, global warming, environmental change.
Gender	Gender differences, male, female.

Note: All facets combined with AND; all terms within facets combined with OR.

Inclusion and exclusion criteria

All retrieved documents were reviewed based on content within the title and abstract to evaluate suitability for inclusion in the final review. Studies for inclusion were original studies reported in English with the main function of reporting public attitudes to climate change. Studies exploring the wider elements of global warming and environmental concerns were also included, provided specific data referring to climate change and/or gender was readily available. Both types of data collection (qualitative and quantitative) were included, as were mixed methods. Studies reporting evidence from both European and American

countries were included. There were no restrictions for age. Studies not meeting the criteria were excluded.

The exclusion criteria were as follows; (1) studies with insufficient methodological detail, (2) studies not reported through the English language, (3) studies with irrelevant focus, (4) studies from countries other than America and Europe and (5) studies in anything other than peer-reviewed published journals (e.g. books or government documentation).

Quality assessment

A data extraction chart was compiled (Table 2), detailing the country of study, study design, method of data collection and study sample. In order to assess the quality of qualitative studies, the instrument 'Consolidated criteria for reporting qualitative research' (COREQ) was utilised (Tong, Sainsbury and Craig, 2007). To assess for the quality of quantitative research, only studies reporting an internal reliability measure of .7 or above were included, with a similar figure being applied for validity. Studies were thus judged as weak, moderate or strong, representing their methodological rigour.

The search resulted in 51 references following the removal of duplicates. Initial checking of titles and abstracts confirmed the results against the inclusion criteria. The reference lists of each paper were screened by hand to check for relevant studies. Three additional studies met the search criteria, thus the completion of the screening and checking process resulted in fourteen studies being included for the final review (Table 2).

Table 2 Summary characteristics of studies of attitudes to climate change ($n = 14$)

Reference and Country	Design and focus	Method, sample and setting	Key findings	Quality and comments
Arnocky and Stroink (2010), Ontario.	Quantitative. Environmentalism and emotional empathy.	Self-report measures (x3), Hypothetical dilemma. Undergraduate students ($n = 202$).	Gender differences across all four environmental measures could be explained by emotional empathy in the predicted direction of women displaying more emotional empathy in general.	Strong reliability across all four measures.
Clements (2012), UK.	Quantitative. Public opinion and climate change.	National Survey (x3), ($n = 3393$).	Using regression analyses measuring three variables; scepticism, awareness and adaptation, women were found to be less aware than men but also less sceptical, whilst no gender effects were found for adaptation.	Strong. All measures were robust in terms of reliability.
Davidson and Haan (2011), Canada.	Quantitative. Climate change, gender and environmental concern.	Population Survey: telephone interview, 18 point scale. ($n = 1,200$).	Women have a higher awareness of climate change and of perceived impact, predominantly associated with socio-economic factors and political ideology.	Moderate.

Table 2 (cont`d)

Dietz, Kalof and Stern (2002), USA.	Quantitative. Values, gender and environmental concern.	Random telephone survey ($n = 345$).	Using factor analysis to explore gender differences in value structures and value priorities to environmental issues, only the priority of altruism was of significant difference, being higher in women.	Moderate.
Dijkstra and Goedhart (2011), Europe.	Quantitative. Gender, Climate change and science.	Secondary school children ($n = 1370$).	Using questionnaires, female students were found to hold more positive attitudes to understanding the global carbon cycle; learning and enjoying it more than males.	Moderate.
Dymen, Andersson and Langlais (2013), Sweden.	Qualitative. Gender, Climate change and environment.	In-depth detailed telephone interviews.	Gender differences in attitudes and responses to climate change were found to be present and positively included within policy design and implementation.	Moderate.

Table 2 (cont`d)

Holmberg and Hellsten (2015), Amsterdam.	Qualitative. Twitter, Climate change and gender.	Analysis of 250,000 twitter `tweets` and `retweets`.	Females made reference to anthropogenic impacts on climate change compared to males who were more sceptical.	Moderate.
Kellstedt, Zahran, and Vedlitz (2008), USA.	Quantitative. Climate change and risk perception.	Telephone survey ($n = 1,093$).	Females were less concerned than males when considering climate change and perceived risk.	Strong.
McCright (2010), USA.	Quantitative. Gender, Climate change and knowledge.	Telephone surveys over 8 year period (2001-2008).	Using regression analyses, women show greater knowledge and concern for climate change but do not perceive themselves as being as knowledgeable as men.	Moderate.
Ojala (2015), Sweden.	Quantitative. Social norms, Environmental efficacy and Climate change education.	Longitudinal study, questionnaire design, 10 th grade students ($n = 684$).	In a combination of statistical analyses, males demonstrate sceptical attitudes to climate change than females across time.	Strong reliability on all measures.
Safi, Smith and Liu (2012), Nevada.	Quantitative. Climate change and Risk perception.	Postal survey over two time periods ($n = 491$).	Using correlations and regression analyses, women demonstrated greater concern and risk	Strong.

Table 2 (cont`d)

			perception for climate change than males.	
Semanza, Hall, Wilson, Bontempo, Sailor and George (2008), USA.	Mixed methods. Awareness, concern and climate change.	Cross sectional surveys.	Using mixed methods, gender and income significantly predicted attitudes to climate change.	Moderate.
Sundblad, Biel and Garling (2007), Sweden.	Quantitative. Risk, worry, climate change and knowledge.	Postal questionnaire adults over 18 ($n = 621$).	When looking at risk judgements on both cognitive and affective levels, women demonstrated higher affective judgements than men, but no difference in terms of cognition.	Strong.
Zelezny, Chua and Aldrich (2000), America.	Quantitative. Age, gender, social responsibility and environmental attitudes.	Questionnaires given to (i) primary and secondary students ($n = 1,293$), (ii) undergraduates in 14 countries ($n = 2,160$) (iii) Personality measures given to university students ($n = 119$).	Across all three studies, females emerged as pro-environmental in behaviour, environmental attitudes, socialisation measures, social orientation and responsibility.	Strong.

Results and Discussion

Overview of selected papers

The purpose of this review was to provide a systematic search for peer reviewed, published articles directly related to gender differences in public attitudes towards climate change over the last fifteen years. This resulted in the final inclusion of fourteen journal articles. Eleven of these were quantitative in nature. Furthermore, the measures employed to gather the data were pre-existing and widely used questionnaires, resulting in Cronbach's alpha reliability figures reported in each study of above 0.7 with seven studies including figures in excess of 0.9. As a result the methodological properties of the quantitative studies were deemed rigorous. Likewise, the remaining three qualitative and mixed method papers were judged to be of sound methodology. Quantitative study sample sizes drawn from the population varied from a relatively small sample of 202 (Arnocky & Stroink, 2010) to an impressive figure of 3393 (Clements, 2012).

Several common themes emerged from the review; particularly so in terms of the emotional empathy, concern and emotional awareness expressed by females, over and above that of males. Nine of the fourteen studies reported at length on issues relating to empathy, concern or awareness (Arnocky & Stroink, 2010; Davidson & Haan, 2012; Dietz et al., 2002; Holmberg & Hellsten, 2015; McCright, 2010; Ojola, 2015; Safi et al., 2002; Sundblad et al., 2007; Zelezny, 2000). A further theme to emerge focused on the perceptions of risk compared to attitudes of scepticism. Six of the fourteen studies examined participants' attitudes in terms of these dimensions (Kellstedt et al., 2008; Safi et al., 2002; Sundblad et al., 2007; Ojola, 2015; Holmberg & Hellsten, 2010; Clements, 2012). Findings revealed that females were more risk focused whilst males were more likely to be sceptical of the effects of climate change; e.g. Clements (2012), and Ojola (2015). Unsurprisingly education played a

role in several of the papers and political ideology was discussed in relation to gender specifically in the paper produced by Davidson & Haan (2010). Moreover, some papers were less pertinent than others; Semenza et al. (2008) and Kellsted et al. (2008) referred to gender effects as an additional consideration rather than a part of their main analyses, hence the detail provided in these instances was superficial to the main objective of the review.

Gender differences in emotional empathy, awareness and concern

In line with the rationale identified within the introduction, nine of the fourteen studies reported distinct gender differences relating to empathy, awareness and concern. Arnocky and Stroink (2010) measured emotional empathy (Emotional Empathic Tendency Scale; Mehrabian & Epstein, 1972), environmental concern (Schultz's 12 item self-report measure; 2001), environmental behaviour (Arnocky, Stroink & DeCicco 2007), and additionally employed the use of the commons dilemma (Self-Report Common Dilemma; Arnocky et al., 2007), to measure co-operative behaviours between participants. They concluded that women consistently report more concern for the ecosystem largely because of the gender role socialisation process, which results in the development of empathy; a key factor in the observed altruistic concerns and co-operation for the sake of the ecosystem. There were no gender differences in environmental behaviours and surprisingly empathy did not correlate with biospheric concerns; however the authors acknowledge that this is probably a result of the particular measure used to assess empathy. A further methodological issue may result from the use of a relatively small sample of student participants, dominated by the female gender, thus questioning its representativeness of the normal population.

In a series of three studies, Zelezny (2000) examined gender differences in attitudes and behaviours within primary and secondary school children in order to test if environmentalism begins in adulthood, as a result of socio-cognitive developmental processes; (Study 1), and with university students across fourteen counties, over two years, to explore Davidson and Freudenberg's (1996) proposal that gender differences in environmentalism are not universal; (Study 2). Findings purported that in Study 1, environmentalism does not begin in adulthood, questioning the assumption that environmental attitudes arise from social and cognitive developmental influences. The results from Study 2 suggest that as a group, females across all 14 countries reported significantly stronger environmental attitudes, stronger value-based eco-centric environmental attitudes, and greater participation in pro-environmental behaviours. These findings suggest that gender differences in environmental attitudes are universal, refuting Davidson and Freudenberg's (1996) claim that differing child rearing practises will result in cross cultural differences. As a result Study 3, involved 119 participants completing a survey on environmental attitudes, gender orientation, socialized other orientation, and social responsibility. The results corroborated the findings from Studies 1 and 2 and reported additional findings, in that for gender socialisation, socialised other orientation, differences in environmental concern and levels of social responsibility, females, compared to males, had consistently higher levels.

However, there were limits to their investigation; they did not compare the performance of children against adults, they did not perform longitudinal analyses nor did they explore the reasoning behind why cognitive, moral or social mechanisms impact on environmental awareness. Moreover, the sample in Study 2 was not representative in many ways; the participants were university students; therefore, sampling bias and generalisability were a concern and they relied upon the use of self-reporting as a technique for data collection which is open to the influence of social desirability in responding.

McCright (2010) explored 8 years of Gallup data from the US general public regarding climate change knowledge and concern. Women were found to demonstrate greater scientific knowledge of climate change than men, however they consistently underestimated this. They also expressed greater concern for climate change effects, a divide not accounted for by their values and beliefs, or the different social roles that men and women perform in society. Moreover, Dietz et al., (2002) reported that differences in men's and women's value orientations may explain gender differences in environmental concern. They purport that it is the difference in the value priority for altruism that mediates the observed differences in environmentalism. They propose that future research should better identify the point during the life course, where substantial gender differences in climate change concern first emerge, along with the acknowledgement that they were unable to explore potential ethnic variations in relation to this.

Gender differences in scepticism and risk

In addition to awareness and concern, several studies also explored the influence of risk and scepticism. For instance, Ojola (2015) investigated reasons for adolescents' lack of acknowledgement of the serious nature of climate change. Eleven measures were taken from a Swedish adolescent population, including media use, environmental values, hedonistic/egoistic values and political orientation. Findings suggested that the likelihood of young people embracing climate sceptical attitudes is greater the less knowledge, the less importance, the less interest they have in political issues and the less environmental efficacy they feel. Moreover, the more strongly they harbour hedonistic values and the more they perceive their parents and peers as possessing climate change scepticism, the more likely they are to score highly on measures of this. A further Swedish study, Sundblad et al., (2007)

focused on the cognitive and affective components of risk judgements for climate change. Taking into consideration participant demographics of age, parenthood; status and educational level, urbanisation and residence, they found that the cognitive perceptions of risk were no different between males and females; however, the affective component of risk was higher in females, resulting in an overall difference of risk perception, manifesting as worry in females. Demographic information had no impact on risk perception at all.

Safi et al., (2012) also investigated risk perception and vulnerability. Whilst vulnerability held no significance for climate change concern, yet again gender was reported to play an important role in shaping risk perception. Women were more concerned than men regarding the impact of climate change, however, Safi et al., argue that this may arise from a lack of gender equity and differentiated political power. Indeed, the impact of political orientation is also highlighted by Davidson & Haan (2010), who used an 18-item module of the All-Alberta Survey (2006) and reported results demonstrating high levels of awareness in women above that in males, coupled with a higher sense of perceived impacts about climate change. They proposed that these gender differences were predominantly associated with socioeconomic factors and political ideology; they argue that one of the most important determinants of climate change risk perception is beliefs regarding the causes of climate change itself. This compliments McCright`s findings that women possess more scientific knowledge of climate change than men; demonstrating a greater awareness and concern for the anthropogenic causes of climate change in general.

In a recent analysis of pro-environmental attitudes on twitter, Holmberg and Hellsten (2015), indicated that overall male and female tweeters use similar language in their tweets, but clear differences emerge in their use of hashtags and usernames; with female tweeters mentioning significantly more campaigns and organizations with a convinced attitude towards anthropogenic impact on climate change, compared to male tweeters referring to a

sceptical stance. Returning to Davidson & Haan, who argue that the gender gap in climate change beliefs and perceived impacts is not attributed to gendered social roles, but related to the lower tendency for women to ascribe to a conservative political ideology relative to men, it may be clear then, that political ideology has an impact on climate change beliefs.

Clements (2012) proposes that climate change scepticism is associated with factors such as being male, less well educated, supporting the Conservatives and having right-wing ideological beliefs. Using the Eurobarometer, the Department for Environment, Food and Rural Affairs (DEFRA) Survey 2009 and the British Social Attitudes (BSA) Survey 2009, Clements argued that there is a clear gap in attitudes between men and women towards climate change. Moreover, men are less likely to support initiatives to reduce the effects of climate change; however those more highly educated will demonstrate more awareness and less scepticism in general.

Conclusion

The findings of this systematic review indicate that in general females demonstrate attitudes of a pro-environmental nature over and above those of men. The main focus for the majority of studies was the observation that women report more concern and awareness for the ecosystem, display more altruistic concerns, a willingness to co-operate together for the benefit of the eco-system and strong value based principles for eco-centrism. Reasons offered for these findings were varied, ranging from the gender role socialisation process to the influence of political ideologies. Whilst many studies appeared to contradict one another in terms of the relative contribution of the socialisation process in explaining the gender divide, it was evident that they agreed concerning the underpinning value based orientation of women towards altruism (Dietz et al.). Women consistently placed higher values on social

responsibility and concern for others, from a young age, across societies and across cultures. This is supported by a recent study reporting that women have stronger emotional aversions to potential harm than men and are more empathetic to the feelings of others (Friesdorf, Conway, & Gawronski, 2015). This study also concluded that the reasons behind female moral judgements are affective as opposed to cognitive, given that when compared, men and women engage in similar levels of rational thinking about the outcomes of harmful action. This was observed in the study conducted by Sundblad et al., (2007) who reported that the cognitive elements of risk were similar across the genders, but the affective component was deemed much higher in females, representing itself as environmental worry or concern. Only one study reported findings in contradiction to this; Kellsted et al., (2008) who found that women and non-whites were less environmentally aware than their male white counterparts. Whilst the researchers acknowledged this anomaly, they were unable to provide potential reasons for it. Additionally, the role of education was evident in a few studies; for example Dijkstra & Goedhart, (2011) reported findings in line with Dietz et al. that female students demonstrated greater awareness of scientific knowledge in terms of climate change and expressed greater interest. Finally, two qualitative studies were of limited value; Semenza et al., and Dymen et al., (2013) where the focus of enquiry was of a broader perspective and of less relevance to the current literature review. In conclusion, there is no doubt that gender differences emerge in participants' consideration of climate change, however what is also apparent, is that these differences are diverse, dynamic and a source of continued fascination for the social scientist.

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