



ARTICLE

The Influence of Caregivers and Environmental Education during Childhood on Adult Pro-environmental Motivation and Behaviour

Sarah Ferguson¹  and Tristan Snell²

¹Swinburne University, Melbourne, Australia and ²Deakin University, Melbourne, Australia

Corresponding author: Sarah Ferguson; Email: 103920101@student.swin.edu.au

(Received 16 January 2023; revised 15 January 2024; accepted 15 January 2024)

Abstract

Although individuals are exposed to a variety of pro-environmental influences in childhood, it is unclear which has the biggest impact on adult beliefs and behaviour. The aim of the current study therefore examined how formal sustainability education and childhood caregiver pro-environmental motivations, beliefs and behaviour, influence motivations and behaviours in adulthood. An Australian adult sample ($n = 230$) completed a survey measuring pro-environmental motivation, anthropogenic climate change beliefs and pro-environmental behaviour. Recollections of childhood caregivers' anthropogenic climate change beliefs and pro-environmental behaviours, and formal completion of sustainability education were obtained. Hierarchical multiple regression analysis found childhood caregiver pro-environmental behaviour significantly and uniquely predicted pro-environmental behaviour. Moderation analysis found no influence from formal sustainability education on this relationship. Caregiver and individual climate change belief were associated, but caregiver belief was not associated with pro-environmental motivation. No differences in adult pro-environmental behaviour were noted when considering childhood sustainability education. Results suggest transmission of anthropogenic climate change belief and pro-environmental behaviour occurs from childhood caregivers. Comparatively, formal childhood sustainability education was not significant in establishing ongoing pro-environmental behaviour patterns. This research adds to limited existing literature demonstrating caregiver impact on sustained pro-environmental behaviour and provides possible future direction for promoting sustainable behaviour.

Keywords: Anthropogenic climate change; pro-environmental behaviour; pro-environmental motivation

Introduction

Previous research has attempted to understand how and when pro-environmental behaviours, driven by underlying attitudes, motivation and beliefs, are formed (Byerly et al., 2018; Carmi et al., 2015a; Howell & Allen, 2019; Steinhorst & Klockner, 2018). The antecedents of children's attitudes and behaviours has been a focus of previous research, based on the understanding that these factors may influence a lifetime of pro-environmental behaviours, such as reducing waste and the consumption of natural resources (Braun et al., 2018; Evans et al., 2018; Liu & Chen, 2021; Otto et al., 2019; Stevenson et al., 2019). Despite evidence of parental impacts on other prosocial childhood attitudes and behaviours (Batool & Lewis, 2020; Simunovic & Babarovic, 2020), there is little information detailing the impact of childhood caregivers on pro-environmental behaviour, which highlights a gap in the literature considering the significance of caregiver behaviour and attitudes on their children (Iwaniec & Curdt-Christiansen, 2020; Leppanen et al., 2012). The

research question of the current study was therefore: Does caregiver environmental knowledge, pro-environmental behaviour and formal sustainability education in childhood, predict increased levels of adult pro-environmental motivation and behaviour?

There has been an emphasis on formal environmental education programmes and frequency of time in nature during childhood, rather than caregiver beliefs or behaviours, as primary factors which increase pro-environmental attitudes and behaviour (Clayton et al., 2019; Collado et al., 2020; Rousell & Mackenzie-Cutter-Knowles, 2020). Otto et al. (2019), using a longitudinal data set, suggested differences when behaviour and attitudes are formed, with pro-environmental behaviour developing continuously during childhood to become an established trait in early adulthood, in contrast to environmental attitudes which fluctuated until middle age. While some longitudinal research suggests that childhood maternal pro-environmental attitudes and behaviour can impact ongoing pro-environmental behaviour in adulthood, findings are difficult to generalise, given relatively small sample sizes and a lack of controlling other potential influences (Evans et al., 2018). Handy et al. (2021) found evidence with a South Korean sample, supporting the occurrence of intergenerational transmission of pro-environmental behaviour from childhood caregivers but findings may be difficult to generalise to Western populations and therefore further cross-cultural research would be beneficial. This is due to existing literature which indicates that cross-cultural parenting styles influence how social values are internalised, including pro-environmental values (Garcia et al., 2018; Queiroz et al., 2020).

Socialisation is defined as the process of identity development during childhood, influenced by caregivers, which likely incorporates the establishment of pro-environmental attitudes and behaviours (Leppanen et al., 2012). Gronhoj & Thogersen, (2009) suggest that pro-environmental attitudes develop from childhood socialisation, influenced specifically by parent pro-environmental attitudes and behaviour. Simunovic and Babarovic (2020), in a recent literature review, also argue that parent beliefs are a socialising influence on their children's academic learning and outcomes, which may be comparable to the transmission of environmental learning and behaviour. Pairwise comparison by Leppanen et al. (2012) displayed a statistically significant correlation between daughter's and father's positive environmental attitude, which was not replicated when comparing either parent's attitude with that of sons. This finding suggested differences in childhood environmental attitudes due to learned societal expectations of gender, adding support for the role of socialisation, but was limited to examining child attitudes, instead of actual pro-environmental behaviour later in life. Alongside the caregiving impact on socialisation, societal influences are likely to include formal education, with social learning occurring not only through curriculum but also behaviour modelled by teachers (Edingyang, 2016).

When examining underlying influences for the establishment of pro-environmental behaviour, it is important to acknowledge that substantial and cross-cultural evidence demonstrates discrepancies between environmental knowledge and pro-environmental behaviour (Braun et al., 2018; Carmi et al., 2015a; Dunn et al., 2020; Liang et al., 2018; Rosa & Collado, 2019; Wi & Chang, 2019). To explain this discrepancy, motivations for environmental behaviour are considered as a key underlying factor for study in this area. Meta-analysis by Osbaldiston and Schott (2012) found intrinsic pro-environmental motivation predicted sustained pro-environmental behaviour, which was observed rather than self-reported. To better understand pro-environmental behaviour, scales have been created to measure pro-environmental motivation in this area of research, including the Stage Model of Self-regulated Behavioral Change (SSBC, see Figure 1), created by Bamberg (2013). For the purpose of the current research, it may be important to understand how pro-environmental motivation develops during formative years by examining the impact of childhood caregivers, if increasing underlying motivation promotes pro-environmental behaviour throughout the lifetime. Caregiver influence may be measured by the transmission of childhood caregiver belief in anthropogenic climate change, as compared to adult belief and through also assessing levels of adult pro-environmental motivation.

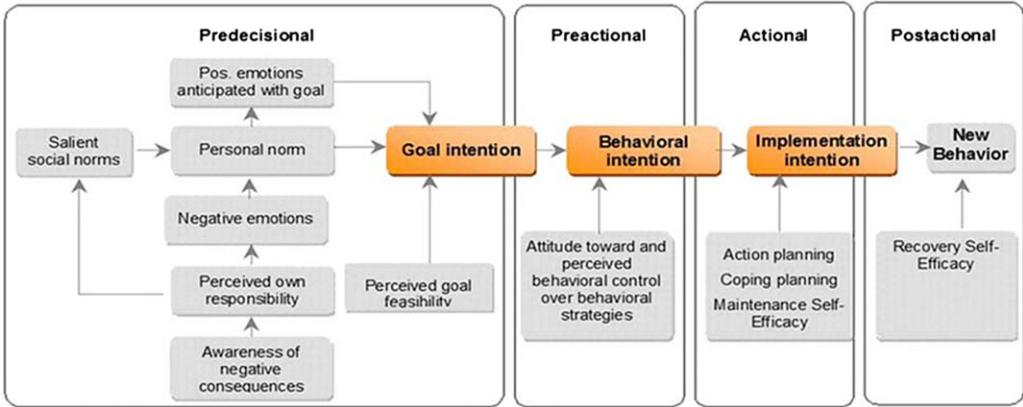


Figure 1. Stage model of self-regulated behavioural change. *Note:* Changing environmentally harmful behaviours: A stage model of self-regulated behavioural change — Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/The-stage-model-of-self-regulated-behavioral-change_fig1_257104879 [accessed 27 Sep, 2021].

There appear to be caveats around how underlying motivations promote environmental action. For example, Carmi et al. (2015b) found domain specific motivation had a clearer effect on pro-environmental behaviour, compared with general pro-environmental intentions. Kjeldahl and Hendricks (2018) suggested understanding environmental motivation may be limited without considering social and emotional contexts, and Carmi et al. (2015a) found emotional investment in the environment was crucial in determining pro-environmental behaviour, mediating the relationship between knowledge and action. Rousell and Mackenzie-Cutter-Knowles (2020) proposed that affect driven interventions focusing on establishing climate change concern during childhood, such as place-based experiences with ecological systems, would be most effective in promoting ongoing pro-environmental behaviour. These findings indicate emotional investment in the environment increases pro-environmental motivation, but do not explain the role caregivers play in establishing emotional investment in the environment during childhood.

Highlighting the influence of family on emotional investment in the environment, Stevenson et al. (2019) found that while acceptance of anthropogenic global warming among adolescents ($n = 426$) was the highest contributor to climate change concern, this was followed by frequency of discussion about climate change with family and friends. Seeking acceptance or approval from family and friends was the third highest contributor, with family impact being greater than friends. These findings suggest that climate change belief is related to concern for the environment and influenced by childhood caregiver beliefs. Vonk et al. (2019) found participants exaggerated the level of alignment with caregiver belief systems if they perceived the child-parent relationship to be positive, suggesting style of caregiving may be important for transmission of beliefs. These findings highlight that while there are a range of drivers for environmental belief systems, caregivers appear to be a contributing factor to their establishment during childhood.

Existing literature suggests that formal environmental education programmes during childhood can also contribute to forming pro-environmental attitudes and behaviour (Bowers & Creamer, 2021; Collado et al., 2020; Duvall & Zint, 2007), including recent systematic review evidence (Ramadani et al., 2023). However, much of this research refers to specific education programmes, such as being climate change specific or included time in nature (Collado et al., 2020; Duvall & Zint, 2007; Liu & Chen, 2021). There also does not appear to be specific examination of how childhood environmental education influences pro-environmental behaviour later in life. According to a systematic review by Bowers and Creamer (2021), many studies

exploring the impacts of outdoor education during childhood have focused on different outcomes, such as measuring knowledge and attitudes, rather than considering pro-environmental behaviour in adulthood. There is literature suggesting formal environmental education can assist with the development of underlying factors and the promotion of sustainable ongoing behaviour and has indicated Australia as a leader in this space (Karrow et al., 2019; Riley, 2022), but there remains a need for further research with Australian samples to understand the best method or methods for encouraging widespread change at a societal level. Thus, the importance of considering the role of formal environmental education, alongside intergenerational transmission of pro-environmental behaviour, to compare which demonstrates a higher impact on long-term behaviour or interaction effects within the same sample. Considering both has not been as thoroughly studied and may be pertinent, as not all children will have equal opportunity for pro-environmental learning from childhood caregivers or time spent in nature and may rely on environmental education programmes which could be mandatory and consistent for this learning.

Overlap between factors which contribute to pro-environmental behaviour during childhood appears likely; for example, caregivers with increased pro-environmental attitudes and behaviour, may more frequently expose their children to time in nature or engage them in formal sustainability education. While there is research indicating that both caregiver behaviour and formal environmental education during the early years can contribute to increased pro-environmental behaviour in adulthood, impacts from these variables do not appear to have been compared with the same sample. Existing studies have not scrutinised interactions between childhood caregiver pro-environmental behaviour and formal childhood sustainability education when examining their outcomes for ongoing environmental behaviour. Soryte and Pakalniskine (2021) considered the role of school and parents in promoting pro-environmental attitudes and behaviour; however, this did not incorporate specific sustainability learning at school. Formal environmental education may be significant in consolidating pro-environmental learning from childhood caregivers, with the opportunity for both being likely to result in higher levels of sustained pro-environmental behaviour.

The current study

Several studies suggest that pro-environmental behaviour may be the result of a collection of contributing factors established during childhood (Braun et al., 2018; Collado et al., 2020; Evans et al., 2018; Liu & Chen, 2021). Research suggests targeting various underlying drivers to encourage environmental behaviour among children (Braun et al., 2018; Byerly et al., 2018; Osbaldiston & Schott, 2012; Steinhorst & Klockner, 2018). Due to a lack of exploring childhood caregiver influence in comparison to education programmes on pro-environmental behaviour, the research question of the current study was: Does caregiver environmental knowledge, pro-environmental behaviour and formal sustainability education in childhood, predict increased levels of adult environmental motivation and behaviour? The following hypotheses were developed to respond to this research question:

1. Caregiver pro-environmental behaviour will significantly predict higher levels of pro-environmental behaviour in adulthood.
2. Caregiver belief in climate change will significantly predict higher levels of adult climate change belief and motivation for pro-environmental behaviour.
3. Individuals who engaged in formal sustainability education during childhood will report significantly higher levels of adult pro-environmental behaviour.
4. Formal education, such as sustainable and/or environmental programmes during primary or high school, will moderate the relationship between caregiver pro-environmental behaviour and adult pro-environmental behaviour.

Method

Participants

Participants were 230 adults living in Australia ($M = 26$ years), including 162 females, 58 males, six people identifying as non-binary or gender diverse, and four people preferring not to specify gender. This sample was somewhat unrepresentative of population norms, per Australian Bureau of Statistics (ABS, 2020), due to an over representation of younger, female participants. Level of higher education was slightly above population norms, with 42% of this sample having a bachelor's degree or higher, compared to 35% of the general population.

Procedure

Ethics approval was granted by Deakin University's Human Ethics Advisory Group (see *Appendix A*). Participants were recruited through an online survey panel. To improve survey response validity in line with previous evidence, two attention check items were included within random scales (e.g. "for this question, please select three/agree to demonstrate your attention") (Kung et al., 2017). Nearly all participants passed the attention check (responses were 97.8% and 98.7% respectively), supporting the validity of participants responses.

Measures

Demographic questions included age, gender, level of higher education (see Table 1). Prior research suggests that these factors can impact pro-environmental attitudes and behaviour (Blankenberg & Alhusen, 2019, Gronhoj & Thogersen, 2009, Otto et al., 2019, Ozdemir & Guler, 2021, Sousa et al., 2021). Self-reported Social Economic Status (SES) was measured on a ladder scale (Adler et al., 2000). Childhood formal environmental education outcomes required retrospective self-report and were obtained through the item "Did you complete any sustainability specific or conservation education during primary or secondary school? (e.g. outdoor education, sustainable schools' programme, Energy Smart Schools, Waste Wise, Waterwatch, Waterwise and/or Landcare)," where participants could respond with "yes," "no" or "other" with an option to specify more details. One participant could not remember engaging in environmental education and was manually included in the no response group, and a second participant reported completing environmental biology and was included in the yes response group.

Participants belief about anthropogenic climate change was captured through options; "I don't think climate change is happening," "I have no idea whether climate change is happening or not," "I think that climate change is happening, but it's just a natural fluctuation in Earth's temperatures," "I think that climate change is happening, and I think that humans are largely causing it," adapted from Leviston and Walker (2011). Recollection of caregiver's beliefs in childhood required retrospective self-report, using items comparative to items measuring personal beliefs and behaviour with adapted instructions: "During your upbringing, which of the following best describes your caregiver(s) thoughts about climate change." An option "unknown" was added. Individual and caregiver climate change belief were organised into dichotomous variables, with "I think that climate change is happening, and I think that humans are largely causing it," separated from all other outcomes. This was to separate and capture whether belief of anthropogenic climate change was present, as compared with different views of climate change causes.

Markle's (2013) Pro-Environmental Behavior Scale (PEBS) was employed to assess pro-environmental behaviour, having demonstrated suitable internal reliability ($\alpha = .80$). The current research adapted the PEBS Conservation subscale ($\alpha = .74$), to capture mean scores for both individual pro-environmental behaviour and childhood caregiver/s pro-environmental behaviour. This included seven items, such as "How often do you turn off the lights when leaving a room?" with participants responding from (1) *never* to (5) *always*. In order to capture caregiver behaviour,

Table 1. Summary of sample demographics for age, level of education and SES

Variable	<i>M</i>	<i>SD</i>	Min	Max
Age*	26.03	8.72	18	64
Highest level of education	3.64	1.61	1	6
SES	5.80	1.36	1	9

Note: *N* = 230; highest level of education scale 1-7; SES scale 1-10; *measured in years.

retrospective self-report was used and the following narrative preceded caregiver items “For the following questions, where the behaviour of more than one caregiver might be relevant, please respond regarding the caregiver with the strongest views about pro-environmental behaviours. Where questions ask about your upbringing, please consider the majority of your experiences between the ages of 0-18 years.” Internal reliability analyses occurred separately for adapted Individual and Caregiver Conservation subscales, with one item removed to improve internal reliability. Despite this adjustment, internal reliability was relatively low for the adapted Individual PEBS subscale ($\alpha = .61$), possibly due to the low number of items in the scale. Internal reliability was acceptable for the adapted Caregiver PEBS subscale ($\alpha = .79$).

An adapted version of the SSBC was utilised to categorise participants’ level of pro-environmental motivation, based on recommendations by Bamberg et al. (2013). Membership for the four categories was established by combining two items “What is your pro-environmental behaviour goal in the next 4 weeks?”, response options “My goal is to increase my pro-environmental behaviours,” “I would like to increase my pro-environmental behaviours, but am unable to do so at the present time,” “My goal is to stay at same level of pro-environmental behaviour” and “My goal is to decrease my pro-environmental behaviour.” The second item for the adapted SSBC was “In the last month, how frequently have you engaged in pro-environmental behaviours?” with responses *Not at all* (1), *Rarely* (2), *Sometimes* (3), *Often* (4) and *Very often* (5). Pre-actional and actional stages were separated into two further subcategories for a total of six groups; barriers and no barriers, to capture whether motivation was restricted by external factors. One participant did not meet criteria for SSBC categories due to self-reported motivation for pro-environmental behaviour decreasing and was subsequently excluded, given they could not be compared as a single case.

Statistical analysis

Hypothesis one was explored using hierarchical multiple regression analysis to examine whether higher outcomes on the adapted Caregiver PEBS subscale predicted higher outcomes on the adapted Individual PEBS subscale, controlling for age, gender, highest level of education and SES in step one (see Table 2). To assess whether caregiver belief in anthropogenic climate change was associated with both adult belief in anthropogenic climate change and higher levels of pro-environmental motivation, as per hypothesis two, separate chi-square tests of independence occurred. An independent samples *t*-test was used for hypothesis three, to determine whether individuals who reported formal environmental education during childhood also reported significantly higher levels of adult pro-environmental behaviour. PROCESS (Hayes, 2013) was used to test the final hypothesis, examining whether formal environmental education moderated the relationship between childhood Caregiver PEBS subscale and Individual PEBS subscale outcomes. PROCESS works by adding an interaction term between the independent and the moderator variable in a regression model, with the interaction term representing the effect of the moderator on the relationship between the independent and dependent variables, and then tests whether the interaction term is significant or not. All assumptions for statistical analyses were met.

Table 2. Unstandardised (*B*) and standardised (*β*) beta coefficients and squared semi-partial correlations (*sr*²) for each predictor variable on each step of hierarchical multiple regression predicting adult pro-environmental behaviour (*N* = 221)

Variable	<i>B</i> [95% CI]	<i>β</i>	<i>sr</i> ²
Step 1			
Age	-.002 [-.012, .008]	-.37	-.029
Education	.004 [-.043, .051]	-.002	-.002
SES	.036 [-.019, .091]	.085	.084
Gender	-.079 [-.244, .086]	-.062	-.060
Step 2			
Age	.000 [-.008, .008]	-.004	-.004
Education	-.006 [-.037, .049]	.002	.002
SES	.026 [-.025, .077]	.063	.063
Gender	-.100 [-.251, .051]	-.081	-.079
Parent PEB	.281 [.195, .367] **	.399	.397

Note: CI = confidence interval. Values are to three decimal places due to low power of reported statistics. ***p* < .001.

Results

Hypothesis 1

Multiple hierarchical regression was used to test whether caregiver pro-environmental behaviour predicted higher levels of adult pro-environmental behaviour, with the individual PEBS Conservation subscale entered as the dependent variable. To control for gender, cases identifying as gender diverse and unknown were excluded, as there were not enough participants in these groups to retain for comparison. In step one of the analysis (*n* = 220), demographic variables accounted for a non-significant 1.6% of the variance in adult pro-environmental behaviour, $R^2 = .02$, $F(4, 215) = .80$, $p = .525$. In step two, caregiver pro-environmental behaviour accounted for an additional 15.7% of the variance, $\Delta R^2 = 15.7$, $\Delta F(1, 216) = 40.96$, $p < .001$. In combination, the five predictor variables explained 17.3% of the variance in adult pro-environmental behaviour, $R^2 = .17$, $F(1, 214) = 40.82$, $p < .001$. This effect can be considered medium according to Cohen’s (1988) conventions.

Hypothesis 2

A Pearson’s chi-square test of independence (with $\alpha = .05$) found caregiver belief in anthropogenic climate change was significantly associated with adult belief in anthropogenic climate change, $\chi^2(1, N = 230) = 7.96$, $p < .001$, although this association was quite small ($\phi = .16$). A further chi-square test of independence did not find anthropogenic caregiver climate change belief was significantly related to higher levels of pro-environmental motivation; $\chi^2(5, N = 229) = 6.00$, $p = .404$, measured by the adapted SSBC. These results suggest that while childhood caregiver and individual anthropogenic climate change belief were associated, caregiver belief was not related to participants pro-environmental motivation. The mean SSBC outcome for participants stage of change was “actional with barriers,” suggesting a higher average level of motivation for participants ($M = 4.33$, $SD = 1.42$). Due to the lack of association between caregiver anthropogenic climate change belief and higher reported pro-environmental motivation, hypothesis two was not supported.

Hypothesis 3

The impact of formal childhood environmental education on pro-environmental behaviour was explored using an independent sample *t*-test. Dependent and independent variables were appropriate for this analysis and independence of observations was verified. There were sufficient sample sizes for both completion of formal environmental education ($n = 116$) and no formal environmental education ($n = 114$). There was no significant difference on average scores for pro-environmental behaviour, $t(228) = .95$, $p = .295$, when comparing participation in formal environmental education during childhood ($M = 4.00$, $SD = .50$) with no education ($M = 4.00$, $SD = .56$). Hence, hypothesis three was not supported.

Hypothesis 4

Moderation analysis using PROCESS was used to examine whether childhood formal environmental education moderated the relationship between caregiver and adult pro-environmental behaviour. The overall model was significant, $F(3, 226) = 13.83$, $p < .001$, and explained 15.51% of the variance in adult pro-environmental behaviour. However, the interaction term did not significantly predict adult pro-environmental behaviour, $\Delta R^2 = .00$, $\Delta F(1, 226) = .11$, $p = .744$. As no interaction effect was observed, hypothesis four was not supported.

Discussion

The aim of the current study was to examine the influence of childhood caregiver beliefs and behaviours, alongside formal childhood sustainability education, on pro-environmental motivation and behaviour later in life. Hypothesis one was supported, with higher levels of childhood caregiver pro-environmental behaviour predicting higher levels of pro-environmental behaviour in adulthood. No demographic variances influenced pro-environmental behaviour outcomes, despite gender differences in previous research (Leppanen et al., 2012; Vicente-Molina et al., 2018). Analyses did not find support for hypotheses two, although it was interesting that a significant relationship was demonstrated between childhood caregiver and adult belief in anthropogenic climate change, suggesting some transmission of belief about environmental issues, which did not translate to higher levels of pro-environmental motivation. Hypotheses three and four were not supported, as there was no measurable difference in adult pro-environmental behaviour following participation in formal sustainability education during childhood and subsequently no interaction effect when comparing the influence of caregiver pro-environmental behaviour and sustainability education during childhood.

The present study found that caregiver pro-environmental behaviour in childhood predicted 15% of the unique variance for adult pro-environmental behaviour. This is an important finding, given the range of childhood factors found to influence pro-environmental behaviour, including education programmes and time spent in nature (Bowers & Creamer, 2021; Braun et al., 2018; Clayton et al., 2019; Liu & Chen, 2021; Steinhorst & Klockner, 2018). This finding is consistent with research indicating that pro-environmental behaviour is established during childhood and affected by exposure to caregiver behaviour (Evans et al., 2018; Handy et al., 2021), and supports the view that pro-environmental behaviour develops through childhood socialisation processes, with caregivers' influencing underlying factors which contribute to ongoing behaviour (Gronhoj & Thogersen, 2009; Iwaniec & Curdt-Christiansen, 2020). This outcome reinforces that childhood socialisation is an important concept for environmental research, as it demonstrates the importance of holistic and regular early influences in forming and sustaining environmental behaviour.

The present study utilised retrospective self-report to capture perceptions of childhood caregiver pro-environmental behaviour, which allowed for examining the long-term influence on environmental behaviour in later life. Assessing adult behaviour provided clearer insight into the

lasting effects transmitted from caregivers, rather than assessing child behaviour, which can fluctuate until adulthood (Evans et al., 2018). Establishing caregiver pro-environmental behaviour as a significant predictor of ongoing pro-environmental behaviour, provides a unique cultural contribution to existing literature; with much of the equivalent research gained in Asia and Europe (Handy et al., 2021; Iwaniec & Curdt-Christiansen, 2020; Leppanen et al., 2012). Caregivers' influence on pro-environmental behaviour may be different across cultures, with Vonk et al. (2019) finding parenting characteristics authority and autonomy were related to the positive transmission of beliefs to children. Similarly, Queiroz et al. (2020), suggested indulgent and authoritative parenting traits resulted in greater internalisation of environmental values.

Other significant results for this research included the relationship between childhood caregiver and anthropogenic climate change belief in adulthood, somewhat consistent with previous research by Stevenson et al. (2019), which indicated that family of origin played a role in developing climate change belief and subsequent environmental concern. There was no significant association between caregiver anthropogenic climate change belief and higher levels of pro-environmental motivation. Despite the average SSBC classification for this sample being actional with barriers, a substantial portion of the sample did not believe in anthropogenic climate change, in line with childhood caregiver beliefs. This finding suggests that while belief in climate change is likely to be inherited from your childhood caregiver, owning this belief was unrelated to intent to increase pro-environmental behaviour. This outcome is consistent with research demonstrating a divide between environmental knowledge or climate change concern and pro-environmental behaviour (Braun et al., 2018; Dunn et al., 2020; Howell & Allen, 2019; Rosa & Collado, 2019; Wi & Chang, 2019). These results contrast with Iwaniec and Curdt-Christiansen's (2020) finding that parents played an instrumental role in promoting not only environmental literacy in their children, but that transmission of environmental knowledge extended to increased pro-environmental attitudes and behaviour. This suggests differences in inherited pro-environmental knowledge, attitudes and motivation from childhood caregivers, when comparing Australian and Chinese samples and may have interesting implications for understanding transmission of pro-environmental behaviour in an Australian sample, such as considering the influence of parenting styles cross-culturally.

There was no significant difference in pro-environmental behaviour, when comparing completion or no completion of formal sustainability education in childhood. This finding is not supported by various preceding literature, which demonstrated increased pro-environmental behaviour based on formal childhood environmental education programmes (Collado et al., 2020; Duvall & Zint, 2007). Much of the previous research on childhood formal environmental education, has focussed on structured environmental programmes and included an element of time spent in nature, which is different to the present study (Clayton et al., 2019; Collado et al., 2020; Duvall & Zint, 2007). This outcome may indicate that childhood time spent in nature, rather than environmental education, is a stronger predictor for ongoing pro-environmental behaviour. Braun et al. (2018) found that country of origin influenced the effectiveness of formal environmental education programmes during childhood, in promoting pro-environmental behaviour. Considering this, discrepancies observed between exposure to sustainability education and behaviour, may have been reflective of the Australian sample. With 50.4% of this sample reporting completion of formal childhood sustainability education with no significant impact for promoting pro-environmental behaviour, pro-environmental behaviour learning appeared to be more effectively delivered from childhood caregivers compared with formal sustainability education. This may have also been due to a lack of evidenced based or consistent environmental programmes present historically and during the timeframe referred to by participants.

Finally, there was no evidence for formal childhood environmental education having a significant impact on the relationship between caregiver and adult pro-environmental behaviour. Due to limitations in existing literature for directly comparing the influence of these factors on pro-environmental behaviour, interpretation of results is difficult. While childhood caregiver behaviour remained a significant and unique contributor for pro-adult environmental behaviour,

formal sustainability education had no individual or moderating effect. This is despite previous literature finding evidence that childhood environmental education encourages ongoing pro-environmental behaviour. This finding might suggest that caregivers are more influential for Australian children developing environmental habits than formal environmental education provided during the time captured in this study. Childhood caregivers may also display more impact when compared to sustainability education due to the longevity of caregiving relationships, which generally occur throughout the length of childhood and are not restricted to the same time constraints or inconsistencies as engagement in formal education programmes.

Limitations for the current study included an overrepresentation of young, female participants in the sample, when compared to the general Australian population. This may have been important, as gender (Leppanen et al., 2012), level of education (Wang et al., 2011), age and SES (Sardianou, 2007) have been found to influence transmission of pro-environmental motivation and behaviour, with younger age and higher SES status demonstrating more energy conserving behaviour. There were some methodological issues for hypotheses one and four relying on the adapted PEBS subscale, such as low internal reliability for Individual PEBS scores suggesting validity issues. Use of the PEBS Conservation subscale items could reflect financially motivated behaviour, such as the desire to reduce energy bills or the cost of transport, rather than pro-environmental behaviour. Participant feedback supported this, with some describing their underlying motivation for PEBS subscale behaviours being financially driven, rather than representing environmental concern. Formal environmental education type could not be well defined by this study, given the retrospective nature of how this was categorised and may have included a range of education methods differing in intensity, structure and demonstrated effectiveness. Reliance on participant self-report may have also influenced PEBS outcomes when considering definitions for sustainability education or accurately remembering childhood caregiver behaviour.

Future research should aim to replicate findings with a sample more reflective of the Australian population, where using or even creating and validating a more rigorous measure of pro-environmental behaviour may be advantageous to better reflect pro-environmental belief and motivation. Such a measure could capture both individual and caregiver pro-environmental behaviour more accurately for comparison. Alternatively, a different PEBS subscale may be appropriate to use, such as the Food subscale, to reflect higher effort and higher impact environmental behaviour. This could provide better insight into significant outcomes and whether these reflect motivation to conserve environmental resources or lessen the impact of climate change, rather than financial motivation or ingrained habitual behaviour. To better understand the unique impact of caregiver behaviour and examine alternative significant variables, factors which have previously demonstrated an influence on pro-environmental behaviour during childhood, such as time in nature, should be controlled for. It would also be useful to categorise formal environmental education to better capture the impact of this learning during childhood. Considering these findings, future intervention to establish and promote pro-environmental behaviour during childhood, may be best aimed at caregivers. It may also be important to explore how parenting style and the quality of child-caregiver relationships influences behaviour transmission and emotional investment in the environment for this area of research.

This study examined the influence of childhood caregiver pro-environmental behaviour and belief in anthropogenic climate change, on pro-environmental behaviour and motivation in later life. Secondly, this research sought to establish whether formal sustainability education during childhood was associated with adult pro-environmental behaviour, and whether this moderated the relationship between childhood caregiver and adult pro-environmental behaviour. This was important research, as there is limited existing literature which considers the influence of both caregiver influence and formal sustainability education on pro-environmental behaviour throughout the lifetime, with the same Australian sample. Outcomes demonstrated that childhood caregiver behaviour was a significant and unique predictor of pro-environmental

behaviour throughout the lifetime. While anthropogenic climate change belief reflected childhood caregiver belief, there were no significant findings supporting an association between caregiver anthropogenic climate change belief and increased levels of pro-environmental motivation in adulthood. Existing research supports this, often revealing disconnect between environmental knowledge, motivation and behaviour. Findings from the current study supported existing literature, with childhood caregivers being influential in establishing both environmental belief systems and behaviour throughout the lifetime, in contrast to formal sustainability education in childhood, which did not play a significant role. Results were unique to this sample and may provide insight into the transference of environmental belief and behaviour, based on Australian parenting styles. This study may also highlight that while Australia is well regarded globally in terms of current environmental education programmes (Riley, 2022), historically these programmes have not been well imbedded in mainstream curriculum. In summary, outcomes suggest that intervention may have optimal outcomes for sustaining pro-environmental behaviour over of the lifetime, through promoting childhood caregiver pro-environmental behaviour. A programme targeting caregiver pro-environmental behaviour and values, with emphasis on improving future environmental outcomes for their children, may be appropriate to encourage long-term sustainable behaviour.

Acknowledgments. There are no acknowledgments.

Competing interests. There are no competing interests which might be considered as influencing the research.

Financial support. None.

Ethical standard. Ethics approval granted as per Deacon University HEAG and referred to in Procedure. Nothing further to note.

References

- Adler, N., Epel, E., Castellazzo, J., & Ickovics, J. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology, 19*(6), 586–592. <https://doi.org/10.1037/02786133.19.6.586>.
- Australian Bureau of Statistics. (2020). *Education and work, 2019-2020*. Education and Work, Australia, Australian Bureau of Statistics. abs.gov.au.
- Bamberg, S. (2013). Processes of change. BPS textbooks in psychology. In L. Steg, A.E. van den Berg & J. de Groot (Eds.), *Environmental psychology: An introduction* (pp. 267–279). BPS Blackwell. <http://doi.ebookcentral.proquest.com>.
- Batool, S., & Lewis, C. (2020). Does positive parenting predict pro-social behavior and friendship quality among adolescents? Emotional intelligence as a mediator. *Current Psychology: A Journal for Diverse Perspective on Diverse Psychological Issues, 41*(4), 1997–2011. <https://doi.org/10.1007/s12144-020-00719-y>.
- Blankenberg, A., & Alhusen, H. (2019). *On the determinants of pro-environmental behavior: A literature review and guide for the empirical economist*. University of Göttingen Department of Economics Working Papers No. 359. <https://ideas.repec.org/p/zbw/cegedp/350.html>.
- Bowers, A., & Creamer, E. (2021). A grounded theory systematic review of environmental education for secondary students in the United States. *International Research in Geographical and Environmental Education, 30*(3), 184–201. <https://doi.org/10.1080/10382046.2020.1770446>.
- Braun, T., Cottrell, R., & Dierkes, P. (2018). Fostering changes in attitude, knowledge and behavior: Demographic variation in environmental education effects. *Environmental Education Research, 24*(6), 899–920. <https://doi.org/10.1080/13504622.2017.1343279>.
- Byerly, H., Balmford, A., Ferraro, P., Hammond Wagner, C., Palchak, E., Polasky, S., Ricketts, T., Schwartz, A., Fisher, B. (2018). Nudging pro-environmental behavior: Evidence and opportunities. *The Ecological Society of America, 16*(3), 159–168. <https://doi.org/10.1002/fee.1777>.
- Carmi, N., Arnon, S., & Orion, N. (2015a). Transforming environmental knowledge into behavior: The mediating role of environmental emotions. *Journal of Environmental Education, 46*(3), 183–201. <https://doi.org/10.1080/00958964.2015.1028517>.
- Carmi, N., Arnon, S., & Orion, N. (2015b). Seeing the forest as well as the trees: General vs. specific predictors of environmental behavior. *Environmental Education Research, 21*(7), 1011–1028. <https://doi.org/10.1080/13504622.2014.949626>.

- Clayton, S., Bexell, S., Xu, P., Tang, F., Li, W., & Chen, L. (2019). Environmental literacy and nature experience in Chengdu, China. *Environmental Education and Research*, 25(7), 1105–1118. <https://doi.org/10.1080/13504622.2019.1569207>.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. 2nd edition. Lawrence Erlbaum Associates.
- Collado, S., Claudio, R., & Corraliza, J. (2020). The effect of a nature-based environmental education program on children's environmental attitudes and behaviors: A randomized experiment with primary schools. *Sustainability*, 12, 1–12. <https://doi.org/10.3390/su12176817>.
- Dunn, M., Merissimo, D., & Mills, M. (2020). Evaluating the impact of the documentary series Blue Planet II on viewers' plastic consumption behaviors. *Conversation Science and Practice*, 2(10), 1–10. <https://doi.org/10.1111/csp2.280>.
- Duvall, J., & Zint, M. (2007). A review of research on the effectiveness of environmental education in promoting intergenerational learning. *Journal of Environmental Education*, 38(4), 14–24. <https://doi.org/10.3200/JOEE.38.4.14-24>.
- Edingyang, D. (2016). The significance of social learning theories in the teaching of social studies education. *International Journal of Sociology and Anthropology Research*, 2(1), 40–44. <https://doi.org/10.2057/1217>.
- Evans, G., Otto, S., & Kaiser, F. (2018). Childhood origins of young adult environmental behavior. *Psychological Science*, 29(5), 679–687. <https://doi.org/10.1177/0956797617741894>.
- García, O., Serra, E., Zacares, J., & García, F. (2018). Parenting styles and short- and long-term socialization outcomes: A study among Spanish adolescents and older adults. *Psychosocial Intervention*, 27(3), 153–161. <https://doi.org/10.5093/pi2018a21>.
- Gronhoj, A., & Thøgersen, J. (2009). Like father, like son? Intergenerational transmission of values, attitudes, and behaviors in the environmental domain. *Journal of Environmental Psychology*, 29(4), 414–421. <https://doi.org/10.1016/j.jenvp.2009.05.002>.
- Handy, F., Katz-Gerro, T., Greenspan, I., & Vered, Y. (2021). Intergenerational disenchantment? Environmental behaviors and motivations across generations in South Korea. *Geoforum*, 121, 53–64. <https://doi.org/10.1016/j.geoforum.2021.02.020>.
- Hayes, A. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. The Guilford Press. <https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=cat00097a&AN=deakin.b2878325&authType=sso&custid=deakin&site=eds-live&scope=site>
- Howell, R., & Allen, S. (2019). Significant life experiences, motivations and values of climate change educators. *Environmental Education Research*, 25(6), 813–831. <https://doi.org/10.1080/13504622.2016.1158242>,
- Iwaniec, J., & Curdt-Christiansen, X. (2020). Parents as agents: Engaging children in environmental literacy in China. *Sustainability*, 12(16), 1–12. <https://doi.org/10.3390/su12166605>,
- Karrow, D., DiGiuseppe, M., & Inwood, H. (2019). Environmental and sustainability education in teacher education: Canadian perspectives. In D. Karrow & M. DiGiuseppe (Eds.), *Environmental and sustainability education in teacher education. International explorations in Outdoor and environmental education*. Springer. https://doi.org/10.1007/978-3-030-25016-4_1.
- Kjeldahl, E., & Hendricks, V. (2018). Pluralistic ignorance in climate change. In E. Michelsen Kjeldahl & V. Hendricks (Eds.), *The sense of social influence: Pluralistic ignorance in climate change*, EMBO Reports, vol. 19, pp. 5–10. <http://doi.org/10.15252/embr.201847185>.
- Kung, F., Kwok, N., & Brown, D. (2017). Are attention check questions a threat to scale validity? *International Association of Applied Psychology*, 67(2), 264–283. <http://doi:10.1111/apps.12108>
- Leppanen, J., Haahla, A., Lensu, A., & Kuitunen, M. (2012). Parent-child similarity in environmental attitudes: A pairwise comparison. *The Journal of Environmental Education*, 43(3), 162–176. <http://doi.10.1080/00958964.2011.634449>.
- Leviston, Z., & Walker, I. (2011). *Baseline survey of Australia attitudes to climate change: preliminary report*. CSIRO. <http://doi.org/10.5072/83/5849a37373067>.
- Liang, S., Fang, W., Yeh, S., Liu, S., Tsai, H., Chou, J., & Ng, E. (2018). A nationwide survey evaluating the environmental literacy of undergraduate students in Taiwan. *Sustainability*, 10(6), 1730–1751. <http://doi:10.3390/su10061730>
- Liu, W., & Chen, J. (2021). Green spaces in Chinese schools enhance children's environmental attitudes and pro-environmental behavior. *Children, Youth and Environments*, 31(1), 55–87. <https://www.jstor.org/stable/10.7721/chilyoutenvi.31.1.0055>
- Markle, G. (2013). Pro-environmental behavior: Does it matter how it's measured? Development and validation of the Pro-environmental Behavior Scale (PEBS). *Human Ecology*, 41, 905–914. <http://doi.10.1007/s10745-013-9614-8>.
- Osbaldiston, R., & Schott, J. (2012). Environmental sustainability and behavioral science: Meta-analysis of proenvironmental behavior experiments. *Environment and Behavior*, 44(2), 257–299. <https://doi.org/10.1177/0013916511402673>.
- Otto, S., Evans, G., Moon, M., & Kaiser, F. (2019). The development of children's environmental attitude and behavior. *Global Environmental Change*, 58, 1–6. <https://doi.org/10.1016/j.gloenvcha.2019.101947>.
- Ozdemir, T., & Guler, G. (2021). The relationship between environmental consumption consciousness and behavior of university students. *International Journal of Caring Sciences*, 14(2), 1258–1268. <https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=ccm&AN=153590754&authType=sso&custid=deakin&site=eds-live&scope=site>
- Queiroz, P., García, O., García, F., Zacares, J., & Camino, C. (2020). Self and nature: Parental socialization, self-esteem, and environmental values in Spanish adolescents. *International Journal of Environmental Research and Public Health*, 7, 1–14. <http://doi:10.3390/ijerph17103732>

- Ramadani, L., Khanal, S., & Boeckmann, M.** (2023). Content focus and effectiveness of climate change and human health education in schools: A scoping review. *Sustainability*, 15(13), 10373. <http://doi.org/10.3390/su151310373>.
- Riley, K.** (2022). Environmental and sustainability education in teacher education: Canadian perspectives. *Australian Journal of Environmental Education* 39(4), 1–3. <http://doi:10.1017/ae.2022.36>
- Rosa, C., & Collado, S.** (2019). Experiences in nature and environmental attitudes and behaviors: Setting the ground for future research. *Frontiers in Psychology*, 763(10), 1–9. <http://doi:10.3389/fpsyg.2019.00763>
- Rousell, D., & Cutter-Mackenzie-Knowles, A.** (2020). A systematic review of climate change education: Giving children and young people a 'voice' and a 'hand' in redressing climate change. *Children's Geographies*, 18(1), 191–208. <http://doi.10.1080/14733285.2019.1614532>.
- Sardianou, E.** (2007). Estimating energy conservation patterns of Greek households. *Energy Policy*, 35(7), 3778–3791, <http://www.sciencedirect.com/science/article/pii/S0301421507000262>
- Simunovic, M., & Babarovic, T.** (2020). The role of parents' beliefs in students' motivation, achievement, and choices in the STEM domain: A review and directions for future research. *Social Psychology of Education*, 23(3), 701–719. <https://doi.org/10.1007/s11218-020-09555-1>.
- Soryte, D., & Pakalniskiene, V.** (2021). Environmental attitudes and recycling behavior in primary school age: The role of the school and parents. *Psichologija*, 63, 101–117. <https://doi.org/10.15388/Psichol.2021.30>.
- Sousa, S., Correia, E., Leite, G., & Viseu, C.** (2021). Environmental knowledge, attitudes and behavior of higher education students: A case study in Portugal. *International Research in Geographical and Environmental Education*, 30(4), 348–365, <https://doi.org/10.1080/10382046.2020.1838122>,
- Steinhorst, J., & Klockner, C.** (2018). Effects of monetary versus environmental information framing: Implications for long-term pro-environmental behavior and intrinsic motivation. *Environment and Behavior*, 50(9), 997–1031. <https://doi.org/10.1177/0013916517725371>
- Stevenson, K., Peterson, M., & Bondell, H.** (2019). The influence of personal beliefs, friends, and family in building climate change concerns among adolescents. *Environmental Education Research*, 25(6), 832–845. <https://doi.org/10.1080/13504622.2016.1177712>,
- Vicente-Molina, M., Fernandez-Sainz, A., & Izagirre-Olaizola, J.** (2018). Does gender make a difference in pro-environmental behavior? The case of the Basque Country University students. *Journal of Cleaner Production*, 176, 89–98. <https://doi.org/10.1016/j.jclepro.2017.12.079>.
- Vonk, J., Zeigler-Hill, V., Cater, T., & Aradhye, C.** (2019). Believe what I believe: Correspondence between the beliefs of young adults and the perceived beliefs of their caregivers. *The Journal of Genetic Psychology*, 180(2-3), 103–113. <http://doi.org/10.1080/00221325.2019.1596877>,
- Wang, W., Li, X., & Li, H.** (2011). Empirical research of the environmental responsibility affected on the urban residential housing energy saving investment behaviour. In *Proceedings of the 2010 International Conference on Energy, Environment and Development*. *Journal of Energy Procedia*, 5, 991–997. <http://www.sciencedirect.com/science/article/pii/S1876610211011118>
- Wi, A., & Chang, C.-H.** (2019). Promoting pro-environmental behavior in a community in Singapore – From raising awareness to behavioral change. *Children, Youth and Environments*, 31(1), 55–87. <http://doi.org/10.1080/13504622.2018.1528496>.

Sarah Ferguson is currently a student and provisional psychologist at the Swinburne University of Technology, completing a Master's Degree in Clinical Psychology. Sarah has previously completed a Master's Degree in Infant Mental Health Science at the University of Melbourne and works in perinatal mental health. Sarah completed the current study as part of research during completion of an Advanced Post Graduate Diploma of Psychology at Deakin University, supervised by Tristan Snell.

Tristan Snell is a senior lecturer at Deakin University and counselling psychologist. He is a researcher in environmental psychology, and has published and presented research on the impact of the environment and climate change on mental health and learning, and works with individuals experiencing anxiety and trauma relating to climate change.

Cite this article: Ferguson, S., & Snell, T. (2024). The Influence of Caregivers and Environmental Education during Childhood on Adult Pro-environmental Motivation and Behaviour. *Australian Journal of Environmental Education* 40, 35–47. <https://doi.org/10.1017/ae.2024.3>