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Examining the Factors That Contribute to Pro-Environmental Behaviour between Rural and Urban Populations

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Abstract: Factors that influence pro-environmental behaviour in individuals can be examined to assess the influence of a single element or combination of elements. In this study, eight factors were investigated for their influence on pro-environmental behaviour: environmental knowledge, environmental attitude, the influence of others, environmental responsibility, age, qualification level, employment status and locality (rural or urban). These factors were established from behavioural theory in the field of psychology, specifically the theory of planned behaviour. Data were collected via an online questionnaire, for which the participants were scored on answers to pro-environmental behaviour questions, which, in turn, were correlated against established influences of such behaviour. A multiple linear regression analysis examined the level of significance that environmental knowledge, environmental attitude, the influence of others and environmental responsibility had on predicting an individual's level of pro-environmental behaviour. An ordinal logistic regression examined the level of significance that age, qualification level, employment status and locality (rural or urban) had on predicting levels of pro-environmental behaviour. The analyses did not detect a statistically significant relationship between any of the independent variables on individual pro-environmental behaviour. However, the level of contribution of each factor provides insights into approaches that can be used in policy formation in the education and marketing domains.

Keywords: pro-environmental behaviour; multiple linear regression; theory of planned behaviour; urban/rural

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1. Introduction

It is now unequivocally accepted by researchers that the stability of the natural environment is under threat from a variety of challenges, with climate change being the most complex, uncertain and largest environmental issue [1]. The IPCC's 2022 [2] report states the observed and projected impacts of climate change, such as increased weather and climate events leading to irreversible impacts on some natural and human systems. Furthermore, it is estimated that 3.3 to 3.6 billion people reside in areas that are highly vulnerable to climate change, with unsustainable development systems increasing the exposure of humans and ecosystems to climate hazards, such as floods, heatwaves and wildfires [2]. One shared aspect that these issues have in common is that they are all human-induced in some form, with consumerism and lifestyle choices being highlighted as significant drivers towards anthropogenic climatic change [3]. Research assessments of the climate system state that the main driver of global warming is increasing concentrations of anthropogenic greenhouse gas emissions [4].

Negative, widespread impacts have already been occurring across human societies and natural systems, such as the loss of species, and increases in diseases and extreme weather events causing humans to migrate and economic loss [2]. In order to reduce this risk, human demands need to replicate what the environment can supply on a sustainable scale. The global ecological footprint (the measurement index of the global consumption of natural resources) has already exceeded the annual limit that the environment can

sustainably renew [5]. This highlights the importance of reinventing the global economic structure, as well as systems of production and consumption. Influencers of decisions and behaviour on an individual scale have received far less attention than those of larger institutional actors [6]. The level of change that can be made at the community, household and individual scales must not be ignored, as these are the people who drive societal change through the support of policies and the adoption of technologies [7].

An alternative term for 'environmentally friendly' behaviour is 'pro-environmental' behaviour (PEB), which is defined as behaviour that aims to minimise the negative impact on the natural and built environment [8]. Researchers have attempted to explain the change towards PEB amongst individuals through several psychological theories. The norm-activation model (NAM) [9] is an example, of which the value–belief–norm theory (VBN) is based on Stern [10]. These theories state that direct predictors of behaviour stem from the activation of personal norms. Moreover, the psychological theory that is most widely supported for exploring the structure of what influences human behaviour change is the theory of planned behaviour (TPB) [11]. The structure of the TPB allows environmental and psychological researchers to identify the influencers of PEB, and to then promote these factors via interventions. The theory outlines three considerations as to how behaviour is influenced [12]:

1. Control beliefs: the factors that affect behavioural performance and their perceived power;
2. Normative beliefs: the expectations of peers and the motivation to comply;
3. Behavioural beliefs: outcomes and their evaluation.

After a certain behaviour is influenced, the likelihood of it actually being performed is determined by behavioural intention, perceived behavioural control and subjective norms. The TPB states that the stronger these determinants are, the higher the probability that the behaviour will be performed [11].

Factors that affect individual PEB were investigated in this study, based on the TPB framework. The variables of environmental knowledge (EK), environmental attitude (EA), the influence of others (IO) and environmental responsibility (ER) were investigated to determine their influences on individual PEB intentions. We also investigated whether the strength of these factors on an individual's PEB varied by locality (urban/rural) and the surrounding levels of deprivation. The level of deprivation in an area has been used in many studies for various aims; however, it has not yet been used to determine the relationship between it and the PEB of residents. The differences in the environmental attitudes, knowledge and behaviour between urban and rural populations has been previously researched. The lack of resources to perform environmentally conscious behaviours, such as using public transport, is difficult in more rural areas due to poor availability. A 2021 UK Department for Transport study found that those in urban environments may not have great appreciation or concern for the environment, yet they behave more pro-environmentally without necessarily realising it, as services are more readily available, such as consistent public transport links [13]. Zulauf and Wagner [14] explore this concept and note that achieving sustainable mobility is harder in rural areas, as many platform-based environmental protection technologies are either unavailable altogether or very limited. However, this lack of resources does not reduce the willingness to act pro-environmentally. Moreover, research commissioned by the UK100 Countryside Climate Network (CCN) and Purpose Climate Lab [15] supports the transport issue, finding that 45% of rural residents are concerned with the prospect of not being able to drive their diesel or petrol cars and are less likely to walk or cycle if any necessary destinations are too far away, compared with those in urban areas. Furthermore, the motivation for behaving in a sustainable manner can be assumed to differ between rural and urban areas regarding what is of visible concern to residents. For example, pollution from exhaust fumes is more prevalent in large cities compared with villages, but, on the contrary, declining biodiversity, which is a result of pollution, is more noticeable in rural areas.

Regarding environmental concern, the CCN [15] found that, of rural residents, 91% are concerned about deforestation, 92% about plastic pollution and 90% about air pollution, with rural residents also being more likely to engage in personal behaviours to reduce their impacts on the climate. Contradictorily, earlier studies identified that a greater degree of environmentalism is displayed from those who reside in urban areas [16]. An explanation offered for this may be that urban areas are generally more heavily polluted, which means that residents have more first-hand experience and therefore concern for environmental issues. Another explanation is that rural residents depend on the environment for their livelihoods, such as extractive industries and agriculture, rather than view it solely for aesthetic or wellbeing purposes. Rural residents who depend on the environment for economic purposes want to conserve the resources in order to maintain a sustainable living [17]. There are a lot of unanswered questions and confusion regarding the link (if any) between the differences in rural and urban populations in terms of their likelihoods of performing pro-environmental behaviours. Therefore, locality acted as a variable in the present study to investigate further whether any significant relationship does exist.

This paper examines the influence of environmental knowledge (EV), environmental attitude (EA), the influence of others (IO) and environmental responsibility (ER) on the likelihood of an individual performing pro-environmental behaviour. Using the questionnaire data obtained, this paper aims to determine whether an individual's level of environmental knowledge, their attitude towards the environment, the influence of others, their level of environmental responsibility, their locality (either rural or urban) and the level of deprivation in their neighbourhood have an effect on their intention to perform pro-environmental behaviour, and to what extent. Therefore, the analyses undertaken examine the extent to which changes in the level (score) of each predictor result in any significant change in the criterion variable.

This paper is structured as follows: the Section 2 describes the questionnaire design and implementation, as well the rationale for the statistical analyses undertaken. The results highlight the key findings, which are subsequently discussed in relation to the literature and statistical observations attained. This paper brings together an important multidisciplinary viewpoint in terms of how environmental sustainability and environmental population research are simultaneously being approached within the fields of psychology and geographical sciences, and by quantitative researchers.

2. Materials and Methods

An online questionnaire was administered using Google Forms, with participants recruited via an opportunity sample. Opportunity sampling is a technique that is often used within the fields of sociology and physiology, and it aims to recruit a snapshot of the population available at the time and willing to participate. This technique can result in data skew and bias, but for this study, these were tested for within the analyses proposed within this section. In addition to questions concerning the influencing PEB factors, population sociodemographic characteristics concerning age, level of qualification, employment status and locality (rural or urban) were also obtained (Table 1).

Table 1. Questionnaire design.

Questions	Source
Environmental Knowledge (multiple choice): Which of the following has the greatest impact on the Earth's environment? Carbon Dioxide, Methane, water vapour, and Nitrous Oxide are examples of what? Animals alive today are more likely to become extinct because? The main source of pollution to our surface water is caused by? *Environmental Attitude (Likert 1–5):*	NEETF and the Roper Group [18]

Table 1. *Cont.*

Questions	Source
Humans have the right to modify the natural environment to suit their needs?	New Ecological Paradigm scale Dunlap et al. [19]
We are approaching the limit the number of people the Earth can support?	
The Earth has plenty of natural resources if we just learn to develop them?	
Despite our special abilities, humans are still subject to the laws of nature?	
Influence of Others (Likert 1–5):	Chan [20]
If the government advised me to reduce my emissions then I would take action to do so	
Part of the reason I recycle is because my neighbours will judge me on bin day	
I would practice more environmentally friendly behaviour if people close to me told me to do so	
Environmental Responsibility (Likert 1–5):	N/A
My personal consumption behaviour have no significant effect on climate change	
The level of impact on the environment informs my lifestyle choices	
Businesses and industry should do more to tackle climate change	
I can walk/cycle where necessary to places from my home (e.g., work, supermarket)	
Pro-Environmental Behaviour (Likert 1–5):	Estrada et al. [21]
In the past two weeks, how often have you used public transport?	
In the past two weeks, how often have you intentionally reduced electricity used in your home?	

The survey questions were designed based on the following established sources. Environmental knowledge was measured using four questions from a 1997 questionnaire administered by the NEETF and the Roper Group that was used to assess environmental literacy [22]. Four questions were taken from this measure in order to keep the overall survey completion time short. Out of the four questions asked in the current study, one related to human activity, one to atmosphere, one to biodiversity and the remainder to water. The proficiency criterion set by the NEETF is 75%, meaning that participants need to answer three questions correctly to display good environmental knowledge. This measure has been adopted within the literature by DeChano [23].

To measure environmental attitude, items from the New Ecological Paradigm (NEP) scale [19] were used. Respondents were asked to indicate their level of agreement to each ecological statement on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). DeChano [23] also used this measure to examine the relationship between environmental knowledge and attitudes. To measure the extent to which individuals are influenced by others to perform pro-environmental behaviour, respondents were asked to respond to a set of statements on a 5-point Likert scale, coded as above. Support for this is achieved through Chan, who investigated the role of mass media, family members, friends and neighbours on a person's waste recycling behaviour. The measurement for the dependent variable of pro-environmental behaviour was taken from Estrada et al. [21], from which the respondents' engagement in conservation behaviours was assessed. Two questions were used, which were again measured on a 5-point Likert scale to assess how often the respondents performed the stated behaviours (1 = not at all, 5 = every day).

All participants were asked for their full unit postcodes (in England and Wales, UK) in order to explore the level of deprivation in their neighbourhoods. The GeoConvert online data service [24] was utilised to match the postcode metadata with the most recent 2019 English Indices of Multiple Deprivation (IMD) [25]. It is worth noting that the measures of deprivation were not based on each specific postcode entered, but on the lower super output area (LSOA), which is the larger geography of the area.

Statistical analyses were undertaken using the IBM Statistical Package for the Social Sciences (SPSS) 25. Firstly, a multiple regression analysis was undertaken. The independent variables of environmental knowledge (EV), environmental attitude (EA), the influence of others (IO) and environmental responsibility (ER) were entered to predict the outcome of the of pro-environmental behaviour (the dependent variable). This method of analysis allows

the variance explained of the model to be assessed, as well as the relative contribution of each independent variable to the total variance explained [26].

Secondly, an ordinal logistic regression was conducted, which generates the same outcomes as a multiple regression analysis; however, it only allows an ordinal dependant variable and noncontinuous independent variables to be entered [26]. This analysis was undertaken to determine the levels of prediction that age, level of qualification, employment status and locality (rural or urban) had on the outcome of PEB. As the dependent variable is required to be ordinal, the PEB scores were categorised into three groups: 'poor', 'moderate' and 'good', in order to meet the statistical test criteria. Thirdly, a Pearson product–moment correlation was used to understand the direction and strength of the linear relationship between the IMD deciles (obtained from respondents' matched postcodes) and PEB score (entered as a continuous variable).

As the questionnaire measured all of the PEB predictor variables and the criterion variable on ordinal Likert scales, these were recoded in SPSS from 1 = strongly disagree to 5 = strongly agree for all the independent variables, and from 1 = never to 5 = every day for the dependent variable (as participants were asked how often they complete a certain 'environmentally-friendly' behaviour). Four of the Likert scales had to be reverse coded so as not to confuse the results. As a multiple regression analysis requires the variables entered to be continuous, the mean was calculated for each variable in each participant's response to give a single numerical score for each variable.

3. Results

The online questionnaire obtained 50 respondents, but with no missing values. To gain an optimal sample size, a power analysis, using Cohen's [27] power primer, was conducted. This is a requirement of quantitative research for the results to achieve significant power. The minimum sample size generated from the power analysis was 84, based on a medium effect size, a probability level of 0.05 and having four independent variables in a regression analysis (or 38 for a large effect size at $p = 0.05$).

Table 2 provides an overview of the respondent characteristics. Respondents were asked to self-identify whether they lived in an urban or rural locale. The quantity of participants living in rural and urban areas was evenly distributed (rural = 24 and urban = 26). Respondents were also asked for their full unit postcodes, and these were also used to independently assign the UK Office for National Statistics (ONS) rural/urban classification [28] to the respondents' locales. Four respondents supplied postcodes that were incomplete, or that did not match the ONS database. To resolve this, an alternative was selected from the same postcode sector, which resulted in the same ONS rural/urban classification.

Table 2. Respondent demographics.

Age	% Response	Economic Activity	% Response	Locale	% Response
18–24	24%	Unemployed	10%	Urban	52%
25–34	44%	Employed (part-time)	4%	Rural	48%
35–44	8%	Employed (full-time)	64%		
45–54	14%	Retired	22%		
>55	10%				
Total	100%		100%		100%

Age is an important characteristic, as age-related changes in communicative and cognitive functioning are significant when conducting questionnaires, highlighting the importance of investigating age differences in behavioural intention [29]. One objective of this study was to investigate whether there was a difference between rural and urban inhabitants in terms of their PEB scores. Having close to identical response rates between

these demographics increases the reliability and validity of the results, as both categories are well represented [30]. Regarding employment status, 66% of respondents were in full-time employment, and the most common qualification level was an undergraduate degree (36%).

Analysing the environmental knowledge (EK) score determined that, out of a maximum of answering four questions correctly, the average score was 2.74, with a standard deviation of 1.34% of participants who achieved a 'good' score, and 26% who achieved a 'high' score. The question that was answered most incorrectly was 'the main source of pollution of our surface water is caused by . . . ', with 36% of the respondents believing it was 'sewage from treatment plants' when the correct answer was 'chemical runoff from farms'. Figure 1 shows the partial regression plots for all the categorised participant scores. The environmental attitude (EA) score found that, out of a maximum score of 5, the average score was 3.78, with a standard deviation of 0.5. Most participants portrayed a 'slight positive' attitude, with 53% reflecting this. The influence of others (IO) score, which was out of 4, displayed an average score of 2.95, with a standard deviation of 0.7. Most participants scored towards the more highly influenced side of the scale, with 46% of the scores falling within this bracket; however, 18% fell in the 'not sure' category, which may have resulted from a scaling issue. The environmental responsibility (ER) score, scored out of 4.75, found that the participants' average score was 2.95, with a standard deviation of 0.6. The most common score was 3.25 (where 20% of participants are grouped), which categorises them at the more responsible end of the scale. The rest of the participants are relatively evenly spread across the scale, displaying a range of results.

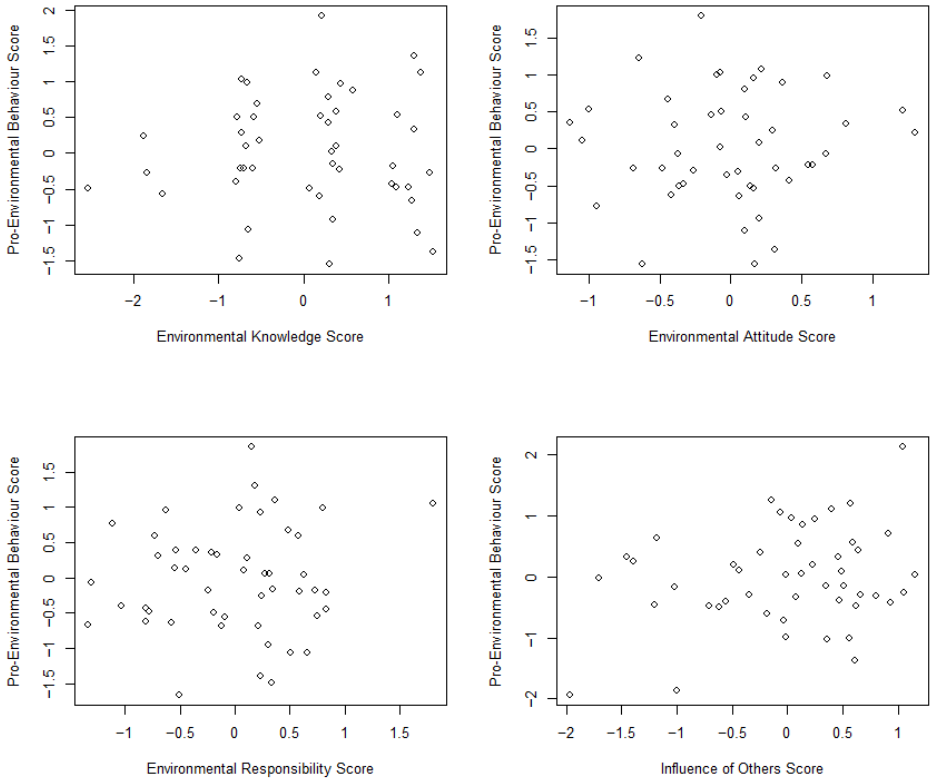

Figure 1. Partial regression plots of scores for participant environmental knowledge, environmental attitude, environmental responsibility and influence of others.

3.1. Main Model: Multiple Linear Regression

In order to run a multiple regression analysis, several assumptions had to be met from the data. Linearity was met, as assessed by partial regression plots and a P–P plot of the regression standardized residuals. There was no evidence of multicollinearity, as there were no tolerance values > 0.1. There were no studentized deleted residuals > +/−3

standard deviations, and no values for a Cook's distance > 1. The assumption of normality was also met, as assessed by a Q–Q plot and histogram. However, two assumptions were slightly violated: there was a small positive skew of studentized residuals versus unstandardized predicted values, implying slight homoscedasticity, and there was also one leverage value > 0.2 at 0.21. Following these assumptions, the multiple regression was not statistically significant at predicting the PEB score ($F(4,45) = 1.112$, $p > 0.005$). None of the four independent variables tested added statistical significancy to the prediction ($p < 0.05$) (Table 1).

Table 3 examines the effects of the predictor variables on a respondent's pro-environmental behaviour, with the significance of the relationship being assessed via a multiple linear regression. In this sample, it can be noted that the influence of others has the greatest impact on pro-environmental behaviour (β coefficient = 0.262, $p = 0.086$). The second greatest effect is attributed to an individual's environmental responsibility score (β coefficient = 0.152, $p = 0.384$). The ER score was assessed by a series of graded statements concerning actions towards environmental responsibility.

Table 3. Results of multiple linear regression analysis.

Variable (Score)	β Coefficient [1]	*p*-Value
Environmental Knowledge	−0.026	0.822
Environmental Attitude	0.083	0.702
Influence of Others	0.262	0.086
Environmental Responsibility	0.152	0.384

[1] The β coefficient indicates the degree of change in the PEB score for every 1 unit of change in each predictor variable.

3.2. Ordinal Logistic Regression

A cumulative odds ordinal logistic regression with proportional odds was also run to determine the effects of age, level of qualification, employment status and locality (rural or urban) on the likelihood of performing PEB. This test was chosen because the above variables are ordinal; yet, we still required a regression analysis to determine their levels of influence. The dependent variable is also required to be ordinal; therefore, the PEB score was recoded in SPSS to meet this requirement.

The assumption of proportional odds was met, assessed via a full likelihood ratio test that compares the fit of the proportional odds model to a model with varying location parameters ($\chi^2(84) = 81.686$, $p = 0.551$). The deviance goodness-of-fit test indicated that the model was a good fit to the observed data (($\chi^2(245) = 139.654$, $p = 1$). The Pearson goodness-of-fit test indicated that the model was also a good fit to the observed data (($\chi^2(245) = 259.099$, $p > 0.001$). There was also no issue of multicollinearity, as all the tolerance values were greater than 0.1.

By inspecting the parameter estimates (Table 4), the following results were obtained. The age category with the greatest odds of obtaining a 'good' likelihood of performing PEB was those aged 34–45 years, with odds of 0.659 (95% CI, from 0.035 to 12.562) times that of the other age categories. However, this is not statistically significant (Wald ($\chi^2(1) = 0.007$, $p > 0.001$). For the level of qualification, the category with the greatest odds of having a 'good' PEB score was those who had an undergraduate degree, with odds of 5.767 (95% CI, from 0.091 to 367.021) times that of the other qualification categories. This, again, is not a statistically significant effect (Wald ($\chi^2(1) = 0.684$, $p > 0.001$). For employment status, those with the greatest odds of having a 'good' PEB score were those who worked part-time, with odds of 0.605 (95% CI, from 0.078 to 4.673) times that of the other categories. Again, this is not a statistically significant effect (Wald ($\chi^2(1) = 0.232$, $p > 0.001$). The odds of participants who live in rural areas obtaining a 'good' PEB score was 0.327 (95% CI, from 0.100 to 1.071) times that of those who live in urban areas, although this is not a statistically significant effect ($\chi^2(1) = 3.408$, $p = 0.065$).

Table 4. Results of ordinal logistic regression analysis.

Variable	Category	Exp(B)	*p*-Value
Age	34–35	0.659	0.781
Qualification Level	Undergraduate Degree	5.767	0.408
Employment Status	Part-time	0.605	0.630
Locality	Rural	0.327	0.065

3.3. Pearson's Correlation

To investigate how the level of deprivation of an area (IMD) could affect an individual's ability to perform pro-environmental behaviour, a Pearson's correlation test was conducted. The following hypotheses were tested in this analysis:

- Null hypothesis: H0 $^{P} = 0$: the population correlation coefficient is equal to zero;
- Alternative hypothesis: HA: $^{P} \neq 0$: the population correlation coefficient is not equal to zero.

There was a small negative correlation between the IMD decile of an area and the pro-environmental behaviour score of the residents ($r = -0.116$); however, the correlation was not statistically significant ($p > 0.05$). A Pearson's product–moment correlation was conducted to assess the relationship between the PEB scores of the 50 participants and the IMD deciles in which they lived. The analyses indicated that only the PEB score variable was normally distributed, as assessed by a Shapiro–Wilk's test ($p > 0.05$). There was no statistically significant correlation between the level of deprivation of an area and the PEB scores of the individuals who lived there ($r\ (48) = -0.116$, $p = 0.431$), with the IMD deciles explaining 1.3% of the variation in the PEB scores. These results determine that the relationship between the deprivation decile and PEB score is not statistically significant. Therefore, we cannot reject the null hypothesis, and we cannot accept the alternative hypothesis.

4. Discussion

As the current climate crisis has been attributed to anthropogenic causes, logistically, it will take a change in human behaviour to help reduce the negative impacts on the environment. Moreover, the reason why responsibility is often displaced onto authoritative figures (e.g., governments) is because average citizens can often perceive that their small-scale pro-environmental behaviours, such as recycling, do not make a significant difference to large-scale climate issues [31]. The differences in the PEBs between rural and urban populations was also investigated due to conflicting previous research [16,17,32,33]. A gap in the research field was identified, as the use of the Index of Multiple Deprivation (IMD) has been previously studied in many domains, and namely in the field of health [34,35]. Therefore, whether the level of deprivation has a significant effect on individual level of PEB, as well as the influence of others [36] was given additional consideration within this study.

4.1. Environmental Knowledge and Level of Qualification

The data from this study identified that EK is not a statistically significant indicator of PEB. This does not support the model of responsible environmental behaviour (REB), which identifies knowledge of environmental issues as a significant contributor to REB. Knowledge is interconnected with education, as an individual's knowledge of a particular subject stems from the level of education they received on it [37]. Education has been labelled as a major influence on the level of environmental concern and behaviour of an individual; those who are educated to a higher level are more likely to display PEB, as they have more information on environmental issues [38]. The present data found that 36% of the participants had achieved an undergraduate degree as their highest level, and 60% of the participants achieved a 'good' or 'high' score on the environmental knowledge test. This follows previous researchers' notions that the higher the level of education, the

higher the level of environmental knowledge. However, the results from the statistical analysis did not support this finding, as the level of qualification or level of EK did not act as statistically significant predictors of PEB in this study.

Policy formations to promote PEB to the public are generally implemented through knowledge-based campaigns to overcome the psychological barriers of misinformation and ignorance. Pratkanis and Turner support this study's findings, as they have stated that knowledge may not directly result in behaviour change but rather in the influential mechanisms that fuel behaviour. Therefore, although a nonsignificant result was found in the present study, it may act as an influencer on behavioural intention.

4.2. Environmental Responsibility

The level of personal responsibility that individuals have towards performing PEBs was also explored, which stems from the concept of perceived behavioural control (PBC) that is used in the theory of planned behaviour [39–41]; however, it was tailored to suit the needs of the present study and was coined 'environmental responsibility'. The data suggest that the level of environmental responsibility is not a statistically significant predictor of PEB. This opposes previous research on recycling behaviours, which found that PBC was a significant contributor to this, with a lack of recycling facilities having a moderate effect on why people did not recycle [42]. The data also oppose findings from Zareie and Navimipour and Zhu et al., who determined that the level of responsibility towards the environment was a direct predictor of PEB. Moreover, it has been noted that people have a more moral sense of responsibility towards the environment as opposed to a social responsibility [43–45].

4.3. Social Norms

In this study, social norms are referred to as the 'influence of others' (IO), which was to make the survey more understandable to the participants, as they may not have known the term 'social norms' but identify with IO; both terms relate to the same concept. The data suggest that the IO did not have a statistically significant effect on predicting the PEB scores. The average score for the participants on this variable was 2.95 out of a possible 4, implying that most of them were more highly influenced by others than not, as 46% fell into the 'highly influenced' category. This study worked with a small sample size (n = 50 vs. 84 derived from the power analysis). This could explain why the statistical significance is limited (an achieved statistical power of 0.38). However, the observation on the influence of others having the greatest impact on pro-environmental behaviour is supported by the literature and is a useful finding that merits further research. This can be considered by reflecting on the influence of social norms and the rules that the members of a group understand and that influence behaviour without law enforcement [46]. Conforming to certain standards is perceived as gaining rewards or social acceptance as a result, whereas breaching them is associated with social sanctions and disapproval [47]. Schultz et al. [48] also found that social norms influence a person's behaviour, as people were more likely to adopt energy-saving techniques at home once they learned that their neighbours were. In the TPB model, the component of a 'subjective norm' is a social injunctive norm, which refers to the perceptions of the people who are significant to an individual and their approval or disapproval of a behaviour. The TPB proposes that the motivation to perform a behaviour is influenced by social pressures from those of whom a person thinks highly, or significant others [49,50].

4.4. Locality

The results data suggest that the odds of participants who lived in rural areas achieving a 'good' PEB score was from 0.1 to 1 times that of those who lived in urban areas, which is a very marginal difference and was also not statistically significant. However, this follows the general theme that was found in previous research, with little empirical evidence displaying a strong difference between the PEBs of urban and rural residents.

A crossover of factors does not help in identifying a clear difference, as behaviour does not only depend on a person's motivation or views on a matter, but also the resources available to them. For example, rural residents who may have a higher level of environmental knowledge and concern cannot complete pro-environmental tasks, such as using public transport, as these services are either limited or nonexistent (see Section 1). There are additional factors to take into account here that could also include time spent living in a rural location, household tenure, and the accessibility to and distance from other services. Furthermore, there are a variety of typologies used to classify the rural, which include spatial relationships, population density and demographic, socioeconomic and cultural typologies [51]. Rural communities both contribute to climate change through the production of greenhouse gases (particularly methane from agriculture) and are also likely to be impacted by the consequences, on agriculture, tourism and human society (e.g., flood risk [52–54]). The vulnerability and adaptive capacity of rural communities to the impacts of climate change are influenced by multiple factors, which also vary spatially and by sociodemographic status [55]. Therefore, it is observed that rural communities both contribute and have exposed vulnerabilities to environmental pressures, such as climate change. However, the extent to which this is perceived at an individual level and manifests itself in pro-environmental behaviour is variable.

4.5. Index of Multiple Deprivation and Income

The data suggest that there is a small negative correlation between the IMD deciles and PEB scores, with the IMD deciles explaining 1.3% of the variance in the PEB scores. The IMD deciles for both England and Wales represent the levels of deprivation in the areas, categorised from 1 to 10 (1 = most deprived and 10 = least deprived). The results imply that as the IMD deciles increase, the level of PEB decreases. However, the results were not statistically significant, and so we lack the credentials to make meaningful assumptions from the data.

Obtaining postcodes from the participants worked better than expected, as a concern in the design process was that they would not enter their full postcodes, or only the first part, due to concerns about privacy. The ethical guidelines that were followed in this research reassured the respondents enough that they felt confident in disclosing their full postcodes.

Despite the uneven representation of employment, the data suggest that those who work part-time have the greatest odds of achieving a 'good' PEB score (by from 0.078 to 4.673 times); however, this result was not statistically significant. The data assume that those who are in full-time or part-time employment have greater levels of income compared with those who are retired or unemployed. It was taken into consideration that this is not always the case, but the employment status was used as a subtler measurement in this study as opposed to asking the participants their annual incomes. However, future research could use the continuous measurement of income in monetary terms in order to gain a more accurate result.

Following the concept that being in part-time employment results in an individual having a moderate level of income, the data support previous research. Arcury et al. [56] and Arcury and Christianson [57] found, in both studies, that having a higher level of income resulted in a higher level of environmental concern. Herrera [58] explained this by proposing that people with higher incomes are more likely to live in healthy environments (which are usually more expensive), resulting in beliefs that support environmental protection. Furthermore, those who are in employment and consequently have stable incomes are more likely to have higher levels of education, which, as previously mentioned, are associated with a greater level of environmental knowledge and a willingness to act [38]. However, when assessing actual behaviour, an Oxfam report [59] found that the wealthiest 1% of society create twice as much carbon pollution as the 3.1 billion least wealthy, which is fuelled by behaviours related to energy-inefficient transportation and overconsumption.

4.6. Developments for Research and Practice

Quantitative data analysis in relation to environmental sustainability is of vital importance for understanding and informing society, and for the impacts of humans on the word in which we live. Common quantitative environmental research interests are shared amongst the disciplines of psychology, geography and the environmental sciences, as well as others, and they have huge interdisciplinary potential. The results of this paper have shown that there is a need to inform environmental behaviour following established psychology theory. Furthermore, the role of the geographical sciences provides a crucial, additional dimension in terms of the spatial relationship (e.g., variations in deprivation as well human behaviours by location-based classifications). Both disciplines aid the understanding of environmental behaviours by drawing upon quantitative as well as qualitative research approaches.

In terms of practice, this research suggests that the influence of others has the strongest positive effect on pro-environmental behaviour (Table 1). Therefore, developing education resources or marketing materials targeting this influence could be considered a starting point for further developing population pro-environmental behaviours. Within psychology, this can be addressed through the concept of social norms. Cialdini and Trost [46] describe social norms as rules that the members of a group understand and that influence behaviour without law enforcement. Conforming to certain standards is perceived as gaining rewards or social acceptance as a result, whereas breaching them is associated with social sanctions and disapproval [47].

In a more recent study, Schultz et al. [48] discovered that norms also influence one's behaviour, and not solely one's opinions. Individuals actively reduced energy consumption in their homes after learning that their neighbours were engaging in energy-reducing behaviours. Furthermore, Nolan et al. [60] illustrated the influence that social pressure has on pro-environmental behaviour. People were more likely to adopt energy-conserving behaviours when informed of the good conservation methods of other households in the same neighbourhood, compared with those who received information on the money-saving and environmental benefits of reducing energy consumption at home.

In the TPB model [11], the component of a 'subjective norm' is a social injunctive norm, which refers to the perception of people who are significant to an individual and their approval or disapproval of a behaviour. The TPB proposes that the motivation to perform a behaviour is influenced by social pressures from those of whom a person thinks highly, or significant others [50]. However, several meta-analyses have suggested that the construct of subjective norms may have a limited predictive ability on behaviour outcome [61], but this is still an area for additional quantitative research, such as that explored in this paper.

5. Conclusions

The multiple regression analysis determined that the factors EK, EA, IO and ER did not hold any significant power over the prediction of pro-environmental behaviour. An ordinal logistic regression analysis also did not generate any significant results when examining age, qualification level, employment status or locality as predictors for pro-environmental behaviour. Moreover, due to a gap in the research, the level of deprivation of an area (obtained through the IMD) did not have any significant correlation with pro-environmental behaviour, as analysed through a Pearson's correlation coefficient test.

This study is the first of its kind to explore proven factors from the theory of planned behaviour, and to incorporate them with the locality and level of deprivation of an area to examine the prediction of a respondent's pro-environmental behaviour outcome. Although no significant relationship was identified, the originality of the scope can be adopted by future researchers. If a significant result is found, then this could allow resources that promote pro-environmental behaviour to be displaced to areas with the highest deprivation and lowest income. The initial research and statistical outputs shown here provide evidence that there are merits for further research, particularly around (i) applications within different regions and samples sizes, and (ii) the further development of quantitative environmental

suitability research across the fields of psychology and the geographical sciences. The well-established psychological theory and the complementary data science research skills of academics across both fields are well matched to the spatial and sociodemographic approaches developed by geographers.

Basing this research on psychological theory displays the importance of identifying what successfully leads to behaviour change within an individual and applying it to real world policy formation and interventions, such as nudging techniques. As responsibility is often displaced onto government or industry to make effective environmental changes, the power of what can be achieved on an individual scale must not be undermined. Although this research identified no significant results, the concept of examining the factors that influence a person's intention to perform a behaviour should be explored further, and any empirical evidence can be used to guide policy formation specifically for education and marketing.

Limitations and Recommendations for Future Research

A recommendation for future research is to explore further the rural–urban relationship with PEBs, as the previous literature outlined presents inconsistent findings. The present study simply asked the respondents 'do you live in a rural or urban area?' to determine whether there was a difference in the prediction of the PEB scores. Future researchers could ask participants how long they have lived in an area and analyse the relationship between locality and environmental knowledge. This is drawn from the present data, as the question answered most incorrectly was about how chemical runoff from farms is the main source of the pollution of surface water.

A reason for the insignificant results regarding social norms may stem from a measurement issue. The use of a neutral option in the middle of the Likert scales may have interfered with the mean score that was calculated for each participant, as 18% of the mean scores fell into the category of 'not sure'. This may have been accurate, but it could also mean that those who chose 'disagree' on one and 'agree' on another may have received an average score that suggested they chose the neutral option, therefore displaying an inaccurate representation of the actual results.

Due to there being no previous literature that explores the relationship between the level of deprivation in an area and the PEBs of residents, this concept needs to be explored further. Using the same methods as the present study, future researchers should ask for participants' full postcodes to enter into GeoConvert and produce the data for the IMD. Most participants entered English postcodes, bar two who were Welsh. Each country has a varying mode of the IMD, with the ranks and scores measured separately across England and Wales. The deciles represent the same level of deprivation in both countries, however, and so these were used in the present study as a note of caution for future researchers.

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