How Is Climate Change Knowledge Distributed among the Population in Singapore? A Demographic Analysis of Actual Knowledge and Illusory Knowledge

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Abstract: Due to the crucial role of knowledge in promoting public engagement with climate change, this study made an in-depths examination of the distribution of climate change knowledge among different demographic groups. Guided by information deficit model and cognitive miser model, two types of knowledge were investigated, including actual knowledge and illusory knowledge. Using a nationally representative survey in Singapore, this study found demographic effects in climate change knowledge distribution. Specifically, a series of independent sample t-test revealed that the males had more actual knowledge of climate change than the females. The middle aged and elderly adults had less actual knowledge but more illusory knowledge of climate change than the young adults. Compare to the more educated people, the less educated people had more illusory knowledge but less actual knowledge of climate change. People from low-income households reported lower levels of actual knowledge but higher levels of illusory knowledge than those from high-income households. Regarding these significant differences in climate change knowledge among different demographic groups, possible reasons for these variations and implications for designing public education programs are discussed.

Keywords: environmental knowledge; demographic difference; climate change

1. Introduction

Climate change has caused severe consequences to both natural and human systems. To relieve the effects of climate change, concerned governments and authorities have made enormous efforts to slow the pace of climate change and reduce further global warming. It is widely recognized that raising public awareness and understanding plays an important role in improving individuals’ adaptation and mitigation capabilities. Correspondingly, a great many educational programs have been undertaken to disseminate actual knowledge of climate change to the public.

Despite intensive education programs, a number of surveys reported that the public generally had limited knowledge of climate change [1]. Moreover, there are demographic differences in climate change knowledge distribution [2]. For instance, significant gender difference in climate change knowledge was found, with men having poorer climate change knowledge than women [3]. Though a substantial number of studies investigated public understanding of climate change, a major concern is that very little work on climate change literacy systematically analyzed how demographic factors relate to different types of climate change knowledge. Rather, prior research typically includes demographic factors (e.g., age, gender, education level, and household income) as statistical control variables in
multivariate model, often with little theoretical discussion on demographic variations in climate change knowledge. This present study attempts to remedy this situation.

In particular, this study is guided by the primary research question on how people from different demographic groups differ in their knowledge of climate change. We first utilize theoretical insights from relevant literatures on information deficit model and cognitive miser model to re-examine climate change knowledge. Specifically, actual knowledge and illusory knowledge of climate change are both examined. Findings from this study improve our understanding of demographic distribution of climate change knowledge, while also helping authorities and practitioners to formulate more efficient education programs targeting at different segments of population.

**Context of Study—Climate Change in Singapore**

As a low-lying island, Singapore is directly influenced by the rising sea level caused by climate change. Much of the island lies only 15 m above the mean sea level. More seriously, the mean sea level in Singapore has increased by about 3 mm per year over the past 15 years [4]. The nation is also at a high risk of saltwater intrusion caused by rising sea level, which have an impact on the water stored in reservoirs. Moreover, the rising temperature has increased the intensity of weather variability in Singapore, which leads to a potential risk of drought and flood [5].

With increasing concerns on the severe impacts caused by climate change, the critical need of mitigation and adaptation to climate change becomes an urgent public agenda in Singapore. The relevant authorities have developed many plans to fight against climate change, including education programs and national exhibitions, which aim at raising public awareness of climate change [6]. To the best of our knowledge, very few studies have examined how climate change knowledge is distributed across different demographic groups in Singapore. Thus, this study aims to provide an overview of climate change knowledge distribution among different demographic groups in terms of gender, age, education, and income in Singapore.

2. Literature Review & Research Questions

2.1. Information Deficit Model & Actual Knowledge of Climate Change

A firmly held belief that characterizes the approach taken by communicators in climate change mitigation is that “better-informed citizens everywhere are more likely to shape their own behaviors and contribute more positively to protecting their environments” [7]. For example, the Asia-Pacific Media Alliance managed a regional campaign utilizing both traditional and online media to raise public understanding of climate change [8]. Under the tagline “Redraw the Line”, this campaign was launched in Philippines, Thailand, Vietnam, and Bangladesh. The National Climate Change Secretariat (NCCS) in Singapore regularly organizes climate change awareness programs for schools, such as “Stop Melting My Home”. Besides, the NCCS also launch the annual Clean & Green Singapore campaign to enhance public understanding of climate change and promote their engagement in the mitigation and adaptation to climate change [9].

These campaigns are guided by information deficit model, which underlines the influence of factual knowledge on attitude and behavior. Assuming that a lack of knowledge would hinder individuals’ behavioral change, this model stresses the importance of enhancing public understanding. In accordance with this model, many climate change campaigns focus on increasing individual’s factual knowledge. Particularly, they insist that providing information will increase factual knowledge of climate change, resulting in attitude or behavior change [10]. Factual knowledge, also known as actual knowledge, refers to what individuals actually know [11]. As a representation of individuals’ accurate stored information, factual knowledge is usually measured by asking respondents a series of true/false questions about the facts [12,13].

Although the information deficit model is a common approach taken by many communication campaigns, it has been constantly criticized in academic literature. A lot of criticism focused on its
oversimplification. For example, Owens and Drifill [14] indicated that behavior change could be influenced by social, political and cultural factors aside from the provision of information. But more importantly, information deficit model has been criticized for the weak relationship between knowledge and behavioral change. For instance, a number of studies reported that the relationship between increased knowledge and subsequently behavioral change was weak [15–17]. And a few studies that examined the role of factual knowledge in behavioral change had yielded little effects [18,19].

2.2. Cognitive Miser Model & Illusory Knowledge of Climate Change

To explain the null findings between actual knowledge and behavioral change, many scholars in recent years have increasingly argued that people are “cognitive misers” who are reluctant to spend cognitive efforts [20,21]. They proposed that people tend to rely on cognitive heuristics or mental shortcuts rather than actual knowledge as a perceptual filter to form opinions or make decisions. The cognitive miser model further argues that self-perception of knowledge serves as cognitive heuristic devices for rational decision-making [22–24]. However, being susceptible to psychological factors, such as self-serving bias, self-perception of knowledge is very likely to be skewed, resulting in an overestimation of one’s perceived knowledge [21,25]. This circumstance is considered as the illusion of knowing, which denotes the cases when people misperceive themselves as well informed while in fact they are not [26].

The logic line of cognitive miser reasoning is well suited to the context of climate change, since the complexity of climate change issue may give rise to individuals’ illusion of knowing about it. To be specific, climate change lies beyond most people’s life-world and biographical horizons, which makes it hard for people to have a direct observation of climate change [27]. For instance, the causes of climate change are invisible. The signal of climate change is virtually impossible to detect from personal experience. The consequences triggered by climate change are mostly determined by the monitoring of the variations of temperature and precipitation data, which have to take long view. Thus, it is virtually impossible to detect climate change from personal experience. Besides, unlike other natural disasters that cause a single hazard, climate change can cause multiple linked hazards [28].

Given the physical complexities of climate change, it is hard for people to have a comprehensive understanding of this issue. Therefore, people may find it difficult to learn about climate change. Since people tend to utilize heuristic procedures to simplify the evaluation when they are facing with complicated issues [29], it is likely that they might make an inaccurate evaluation of their knowledge of the issue. Accordingly, people may believe that they are knowledgeable of climate change, even though they lack factual knowledge. Thus, we consider that people might develop illusory knowledge of climate change, which influences their decision-making related to climate change.

Moreover, the functional value of illusory knowledge has been extensively discussed in positive illusion model [30], one of the primary theories that have touched upon illusory knowledge. This model proposes that people tend to develop unrealistic views rather than accurate assessments of themselves. The illusion in self-evaluation could bring about positive outcomes, such as enhancing motivations or promoting behaviors [30]. Specifically, the illusory perception reflects exaggerated beliefs in behavior control and self-efficacy, which are predictions of a higher motivation, greater persistence, and more effective action. In consistent with positive illusion model, illusory knowledge of climate change could lead to positive outcomes as well, such as promoting individuals’ behavioral intention to fight climate change.

By acknowledging the role of both information deficit model and cognitive miser model, this study maintains that illusory knowledge could serve as an alternative route to attitude or behavioral change in addition to actual knowledge. Hence, both actual knowledge and illusory knowledge should be considered in designing educational programs to promote public engagement with climate change.
2.3. Demographic Effects in Climate Change Knowledge

More importantly, previous studies suggested that there are demographics effects on public engagement with environmental issues. For instance, men are more likely to perform pro-environmental behaviors than women [31]. Difference in demographics could lead to divergent attitude on whether climate change is an important issue [32]. People from different age and income groups reported significantly different levels of concern about climate change [33]. In line with these studies, we expect that there might be demographic effects in public understanding of climate change. In other words, actual knowledge and illusory knowledge of climate change knowledge might be distinctively distributed among different demographic groups. However, most existing study rarely addressed the demographic effects on these two types of climate change knowledge. To fill in this research gap, this study proposes to make an in-depth investigation of the demographic differences in actual and illusory knowledge of climate change. Thus, we posit the research questions as follows:

RQ1: What is the gender difference in the distribution of (a) actual knowledge, and (b) illusory knowledge of climate change?
RQ2: What is the age difference in the distribution of (a) actual knowledge, and (b) illusory knowledge of climate change?
RQ3: What is the education difference in the distribution of (a) actual knowledge, and (b) illusory knowledge of climate change?
RQ4: What is the income difference in the distribution of (a) actual knowledge, and (b) illusory knowledge of climate change?

3. Methods

3.1. Sample and Data

This research adopted a nationally representative door-to-door survey in Singapore. The stratified sampling procedure was performed so as to achieve a sample that is representative of the population. A group of fifteen interviewers were recruited and trained for the survey. To maximize the response rate, the interviews were done in either English or Mandarin. The next birthday technique, which has been demonstrated to be effective in obtaining randomly representative samples [34], was used to randomly select respondents from each household. Finally, this study obtained a sample of 705 respondents. The age, gender distribution, and education, and household income of the sample were comparable with those of the general population.

Our sample demographics are similar in terms of age and gender distribution to the characteristics of the 2010 Singapore population census [35]. The median age in our sample was 40 years as compared to 37.4 years in the census. In our sample, 54.5% of the respondents were female while 50.6% were female in the census. Education and household income variables exhibited several differences. The median education level attained in the census was secondary education, whereas that of our respondents was “Diploma”. The median household income reported in the Singapore census was $5000, whereas that of our respondents was “$3001 to $4000”. These differences are not of major concern because they were regarded as control variables in this study.

3.2. Measures

Demographics. In this study, demographic variables include age, gender, education (ranged from “1” = “No formal education” to “9” = “Postgraduate”), and monthly household income (ranged from “1” = “1000 SGD and below” to “13” = “above SGD 12,000”).

Actual Knowledge of Climate Change. For actual knowledge, we used 12 items adopted from prior studies on climate change knowledge [36–38]. The respondents were asked to answer if the given statements were “1 = true”, “2 = false”, “0 = don’t know.” Example items include: “The hole in the ozone layer is the primary cause of global warming”, “The output from the Sun contributes to
global warming more than greenhouse gases produced by people” and “Because of climate change, the water in sea and oceans will expand”. The average score of the twelve responses was computed as the scale for actual knowledge (KR-20 = 60), which represents the percentage of correct answers for all twelve items.

Illusory Knowledge of Climate Change. This variable is defined as the discrepancy between actual knowledge and perceived knowledge [26,39]. To be specific, illusory knowledge refers to the case in which the level of perceived knowledge is higher than the level of actual knowledge.

Perceived knowledge was measured by asking the respondents to rate how much they thought they currently know about climate change using a 10-point scale (0 = knowing nothing and 10 = knowing everything). As actual knowledge and perceived knowledge were measured using different scales, this study made a transformation to ensure that the measurements of both actual knowledge and perceived knowledge were on the same scale. In particular, the score for perceived knowledge was transformed into a percentage, which represents the percentage of knowledge that people believe they have about climate change. Finally, illusory knowledge is determined by subtracting the score of actual knowledge from the score of perceived knowledge.

4. Results

A series of independent sample t-test was conducted to examine demographic influences on actual knowledge and illusory knowledge of climate change. Table 1 summarized the basic statistics of the demographic variables and knowledge variables.

Table 1. Summary of statistics of the demographic and knowledge variables.

| Variable          | N   | Min | Max | Median | Mean | SD | Measurement Scale |
|-------------------|-----|-----|-----|--------|------|----|------------------|
| Gender            | 705 | 1   | 2   | -      | 50   |    | 1–2              |
| Age               | 705 | 21  | 84  | 40     | 14.83|    | 21–84            |
| Education         | 705 | 1   | 9   | 7      | 2.02 |    | 1–9              |
| Household Income  | 705 | 1   | 13  | 4.00   | 5.06 | 3.22| 1–21             |
| Actual Knowledge  | 705 | 0   | 1   | 0.58   | 0.55 | 0.02| 0–1              |
| Illusory Knowledge| 705 | -0.82| 0.82| 0.02   | 0.02 | 0.22| 0–1              |

4.1. Gender Differences

Regarding RQ1, which concerning gender differences in climate change knowledge, the t-test results showed that there was a significant difference in the scores for the females (M = 0.53, SD = 0.019) and the males (M = 0.57, SD = 0.20); t (703) = 2.25, p < 0.05. These results suggest that gender difference does have an effect on actual knowledge of climate change. In particular, the results suggest that the males are more knowledgeable of climate change than the females. Table 2 describes the gender differences in actual knowledge and illusory knowledge of climate change.

Table 2. Comparing the mean knowledge scores between male and female.

| Factor            | Groups | Number | Mean ± SD | Sig. (Two-Tailed) |
|-------------------|--------|--------|-----------|-------------------|
| Actual Knowledge  | Male   | 321    | 0.57 ± 0.20| 0.025             |
|                   | Female | 384    | 0.53 ± 0.19|                   |
| Illusory Knowledge| Male   | 321    | 0.01 ± 0.21| 0.369             |
|                   | Female | 384    | 0.03 ± 0.23|                   |

In terms of the gender difference in illusory knowledge, the analysis failed to reveal a significant difference between the females and the males, t (703) = −0.90, p = 0.37. The results suggest that the level of female’s illusory knowledge (M = 0.03, SD = 0.23) was similar to the level of the males (M = 0.01, SD = 0.21).
4.2. Age Differences

RQ2a and 2b consider the age differences in actual knowledge and illusory knowledge of climate change. Given the belief that young people are more sensitive to environmental issues [40], the respondents in this study were categorized into two groups, which include the young adults, and the middle-aged and elderly adults. Based on the age stratification in Singapore, the young people are defined as adults below 40, and the middle-aged and elderly people are defined as individuals above 40 [41]. Of the respondents in this study (N = 705), 52.1% were young adults (N = 367), 47.9% were middle-aged and elderly adults (N = 338). Table 3 describes the age differences in actual knowledge and illusory knowledge of climate change.

Table 3. Comparing the mean knowledge scores between the young and middle-aged & elderly.

| Factor          | Groups                        | Number | Mean ± SD   | Sig. (Two-Tailed) |
|-----------------|-------------------------------|--------|-------------|-------------------|
| Actual Knowledge| Young Adults                  | 367    | 0.59 ± 0.19 | 0.000             |
|                 | Middle Aged & Elderly Adults  | 338    | 0.51 ± 0.20 |                   |
| Illusory Knowledge| Young                        | 367    | −0.01 ± 0.22| 0.002             |
|                 | Middle Aged & Elderly Adults  | 338    | 0.05 ± 0.22 |                   |

With regard to the age difference in actual knowledge of climate change, the analysis revealed a significant difference between the young adults, and the middle aged and elderly adults, t (703) = 5.51, p < 0.001. The results show that the young adults score significantly higher on actual knowledge of climate change than the middle aged and elderly adults (for young adults, M = 0.59, SD = 0.19; for the middle aged and elderly adults, M = 0.51, SD = 0.20). These results suggest that age does have an effect on actual knowledge of climate change.

The analysis of illusory knowledge also revealed a significant difference between the young adults, and the middle aged and elderly adults, t (703) = −3.15, p < 0.01. Specifically, the middle aged and elderly scored significantly higher on illusory knowledge than the young (for young adults, M = −0.01, SD = 0.22; for middle aged and elderly adults, M = 0.05, SD = 0.22). The results show that age has an effect on illusory knowledge of climate change. In particular, the middle aged and elderly tend to believe that they have more knowledge, while in fact they do not have that much actual knowledge. Conversely, the young people are likely to believe that they lack knowledge of climate change, while they actually know a lot about it.

4.3. Education Difference

In terms of education differences in climate change knowledge, a series of independent sample t-test between the less educated and the more educated groups was conducted here. In particular, the respondents were categorized into two groups, including the group without diploma and the group with diploma or higher degree. Of the respondents in this study (N = 705), 54.9% have diploma or higher degree (N = 387), and 45.1% are those who do not have diploma (N = 318). Table 4 describes the education differences in actual knowledge and illusory knowledge of climate change.

Table 4. Comparing the mean knowledge scores between the less and more educated.

| Factor          | Groups       | Number | Mean ± SD     | Sig. (Two-Tailed) |
|-----------------|-------------|--------|---------------|-------------------|
| Actual Knowledge| Less Educated| 318    | 0.49 ± 0.21   | 0.000             |
|                 | More Educated| 387    | 0.59 ± 0.17   |                   |
| Illusory Knowledge| Less Educated| 318    | 0.05 ± 0.23   | 0.000             |
|                 | More Educated| 387    | −0.01 ± 0.21  |                   |

With regard to education difference in actual knowledge of climate change, the results showed that there was a significant difference in the scores for the people with higher education (M = 0.59,
SD = 0.17) and people without higher education (M = 0.49, SD= 0.21; t (703) = −6.33, p < 0.001. In line with previous studies, we found a positive relationship between education and knowledge expertise. Specifically, people with higher education have more knowledge of climate change than those without higher education, which answered RQ3a.

Also, the analysis of education difference in illusory knowledge revealed a significant difference between people with higher education and those without higher education, t (703) = 3.98, p < 0.001. The results showed that people with higher education scored significantly less on illusory knowledge of climate change than did people without higher education (for subjects without higher education, M = 0.05, SD = 0.23; for subjects with higher education, M = −0.01, SD = 0.21). This suggests that people with higher education are less likely to have illusory knowledge as compared to those without higher education. Thus, RQ3b was answered.

4.4. Income Difference

RQ4 considers the household income difference in climate change knowledge. To answer this research question, a set of independent sample t-test to examine the income effects. Specifically, the median value of household income in this study was employed to determine the low and high levels of household income. Of the respondents in this study (N = 705), 51.8% were low household income groups (N = 365), 48.2% were high household income groups (N = 340). Table 5 describes the income differences in actual knowledge and illusory knowledge of climate change.

| Table 5. Comparing the mean knowledge scores between the low and high income households. |
|-----------------------------------------------|-----------------|----------------|----------------|
| Factor                                   | Groups          | Number | Mean ± SD     | Sig. (Two-Tailed) |
| Actual Knowledge                        | Low income      | 365    | 0.50 ± 0.21   | 0.000           |
|                                         | High income     | 340    | 0.59 ± 0.17   |                |
| Illusory Knowledge                       | Low income      | 365    | 0.04 ± 0.23   | 0.006           |
|                                         | High income     | 340    | −0.005 ± 0.21 |                |

Regarding the income difference in actual knowledge of climate change, the result reveals a significant difference between lower household income group (M = 0.50, SD = 0.21) and higher household income group (M = 0.59, SD = 0.17), t (703) = −6.32, p < 0.001. These results suggest that household income does have influence on individuals’ actual knowledge level of climate change. Specifically, individuals with higher household income are more knowledgeable of climate change compared to those with lower household income. Thus, RQ4a was answered. Moreover, the results revealed a significant income difference in illusory knowledge of climate change. Specifically, people from low-income households (M = 0.04, SD = 0.23) have more illusory knowledge than those from high-income households (M = −0.005, SD = 0.21), t (703) = 2.73, p < 0.01, which answered RQ4b.

5. Discussion

This study examined the demographic effects on public understanding of climate change. In term of gender, the findings suggest that man had more actual knowledge of climate change than women. Regarding the effects of age, the young adults had more actual knowledge but less illusory knowledge of climate change than the middle aged and elderly adults. The less educated people had more illusory knowledge but less actual knowledge as compared than the more educated people. Compared to people from high-income households, those people from low-income households had less actual knowledge but more illusory knowledge of climate change. These findings revealed significant differences in public understanding of climate change among different social groups.

Firstly, this study revealed that gender differences exist in actual knowledge but not in illusory knowledge of climate change. This is consistent with previous studies, which reported that the males tend to perform better in science literacy achievement [42–44]. The literature on gender differences in

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science knowledge noted that the gender differences first appear in middle school [45], increase during high school [46], and prevail over the college and beyond [47]. These differences lead to women talking fewer about science than men [48]. The cumulative effect of these distinctions is that men generally tend to be more interested in science topics and demonstrate greater science knowledge than do women [49,50]. In a study on environmental knowledge, Briggs et al., [51] also found that men had higher levels of environmental knowledge than women. Moreover, the imbalance of gender representation in climate change mitigation policies could also explain the gender difference in actual knowledge, which advocated that he better the representation of women, the higher the likelihood that environmental protection and precaution will be prioritised [52,53].

Moreover, the results revealed that the young, and the middle-aged and elderly scored differently in actual knowledge of climate change. The young performed better than the middle-aged and elderly in terms of climate change knowledge. Consistent with prior studies, young people are more knowledgeable of climate change than middle-aged and elderly people. This could be explained by the learning ability differences between the two age groups, as young adults tend to have better sense of recalling and recognizing compared to older adults [54]. Another possible explanation would be that young people have grown up in a time period, in which environmental concerns have been a salient issue, and they are more likely to be sensitive to the environmental issues, such as climate change [40]. In this case, young people are more like to be aware of environmental issues and have more relevant knowledge.

This study also found age differences in illusory knowledge. Specifically, middle-aged and elderly adults are more likely to have positive illusion in their knowledge assessment. In other words, middle aged and elderly adults tend to overestimate their knowledge about climate change. Their overconfidence in self-assessment of knowledge could be possibly explained by the motivation of maintaining life satisfaction. Aging studies found that individuals’ life satisfaction tend to decline with aging [55–57]. The literature on social comparison notes that there is a human tendency that people are driven to develop positive illusion in order to maintain positive self-image or life satisfaction [58]. Furthermore, this tendency increases with the age [59,60]. As the elderly adults have less life satisfaction than the young, it is possible that the older people are more likely to develop positive feeling in order to maintain positive self-image. In this case, the middle-aged and elderly adults may be more likely to believe they have good understanding of climate change, even though they do not have that much actual knowledge. Thus, the middle aged and elderly adults have a significant higher level of illusory knowledge than the young.

Furthermore, this study reveals an education difference in climate change knowledge. Specifically, the more educated tend to have more actual knowledge of climate change than the less educated, which is consistent with prior studies. Environmental studies have long recognized that education is one of the major correlates of environmental knowledge [61,62]. In particular, these studies reported a positive relationship between education levels and environmental knowledge. For example, Brothers et al. [63] found that education was the most salient demographic factor related to environmental knowledge, as the better educated people tend to possess more environmental knowledge. Haron et al., [64] reported that people who had high school education reported a higher level of environmental knowledge than those who had less education than high school. Besides, Pothitou et al. [62] found that people with more environmental knowledge are more likely to behave responsibly in order to protect the environment.

Also, the results suggest that the highly educated people tend to have less illusory knowledge as compared to those who are less educated. This finding is consistent with prior research on optimism bias, which reported a negative relationship between education and the level of bias [65]. Notably, the less educated people tend to have more optimism bias. Moreover, in a study on behavioral bias and demographic characteristics, Bashir et al. [66] reported that people with less education tend to develop a higher level of overconfidence. Besides, people with lower education levels tend to have less life satisfaction. With the motivation of maintain good self-image, they are more likely to develop
positive illusion in comparison with others. Accordingly, the less educated people have more illusory knowledge of climate change while in fact they are not that knowledgeable.

Likewise, this study revealed income differences in climate change knowledge, as people from high-income households reported higher levels of actual knowledge than those from low-income households. One possible explanation could be that people with high incomes tend to have higher levels of education and are more sensitive to social problems such as climate change [67]. Being sensitive to environmental issues would motivate people to pay attention to these issues, which result in a better understanding. Additionally, environmental studies have acknowledged that one of the barriers for individuals’ engagement with climate change is their attention to more immediate priorities, such as finances and family [58]. This would be especially true for people from low-income households, as they have more financial pressure than those from high-income households. In this case, people with less household income are less likely to pay attention to climate change issue, resulting in their poor performance in actual knowledge.

Our findings also revealed income differences in illusory knowledge of climate change. To be specific, people from low-income households tend to overestimate their knowledge about climate change, whereas those who are from high-income households tend to underestimate their understanding of climate change. The income differences in illusory knowledge could be explained by the motivation of maintaining life satisfaction as well. The literature on income inequality documents a positive correlation between household income level and life satisfaction [69,70]. Driven by the need to maintain good image of self, it is possible that people from low-income household may develop more illusory knowledge of climate change.

6. Research Contributions and Limitations

In terms of theoretical contributions, with an acknowledgement of people might be cognitive misers in learning about climate change, we firstly argued that illusory knowledge could an alternative routine for behavioral change in addition to actual knowledge. Furthermore, this study highlights the demographic differences in both actual and illusory knowledge of climate change. By examining the gender, age, education, and income differences in both actual and illusory knowledge of climate change, our study enhanced the understanding of climate change knowledge distribution among the population.

Finally, this study yields important practical implications for designing climate change campaigns and education programs. Specifically, the findings suggest that people from different social groups tend to have different levels of actual knowledge and illusory knowledge of climate change. For example, compared to young adults, the middle-aged and the elderly have more illusory knowledge but less actual knowledge. Given the complexity of climate change issue, the elderly may find it difficult to learn the mechanism behind climate change, as compared to young people. As an alternative, illusory knowledge may be easier to achieve than actual knowledge gain for the elderly adults. In this case, the group differences should be taken into account in designing an effective communication campaign. This suggests that specialized campaign should be designed for the targeted population. In particular, more efforts should be made in planning communication campaign that focuses on promoting the elderly’s pro-environmental behaviors through raising their confidence in understanding.

Moreover, it would be worthwhile to plan specialized education programs for specific target audiences. Since the actual knowledge of climate change is not equally distributed among different demographic groups. To eliminate the knowledge gap in public understanding of climate change, education program planners should be aware of the segments of population who lack actual knowledge. For instance, considering the gender, education, and income differences in actual knowledge, it would be beneficial for practitioners to devote more efforts in enhancing public understanding of climate change among the females, the less educated and the aging population.

Limitations of the study are acknowledged. First, this research was conducted in Singapore. Thus, the findings generated from this study may not be generalized to other countries. Second,
we used a cross-sectional sample in this study. A longitudinal study is much more helpful to provide an accurate understanding of climate change knowledge distribution among the population. Besides, future studies are suggested to explore the factors contributing to public understanding of climate change, so as to decreasing the knowledge gap among different social groups.

7. Conclusions

In summary, this study explored the demographic differences in climate change knowledge. Unlike other studies on knowledge distribution, this study shifted the focus of inquiry from actual knowledge to illusory knowledge. By acknowledging the potential of illusory knowledge in promoting public engagement with climate change, this study made an in-depth examination of illusory knowledge in addition to actual knowledge. Guided by the two competitive models – information deficit model and cognitive miser model – in public understanding of climate change, this study investigated the distribution of actual knowledge and illusory knowledge among different demographic groups. Moreover, this study made a comprehensive examination of the demographic effects on climate change knowledge. Our findings suggest that people from different demographic groups have significant differences in their understanding of climate change.

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