

## REGULAR ARTICLE

# Climate change perception scale: Adaptation and psychometric properties in the Indonesian context

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**Abstract**

One of the crucial factors in changing behaviour towards pro-environmental actions is climate change perception. The latest measurement tool for assessing this variable is the Climate Change Perception Scale (CCPS). However, CCPS has not gained widespread adoption and usage across different cultures, including Indonesia, and no analyses have been conducted to adapt and validate CCPS in the Indonesian context. Therefore, this study aimed to adapt, validate, and assess the measurement tool's consistency in Indonesia's cultural context. To investigate the instrument's psychometric properties, two studies ( $n=358, 415$ ) were conducted in Indonesia to provide evidence of the internal consistency, convergent validity, and predictive validity of CCPS. The results of a confirmatory factor analysis (CFA) showed that the Indonesian version of CCPS, which consists of 15 items, with three for each dimension, accurately and reliably measured perception of climate change. CCPS also demonstrated good convergent validity, as indicated by the significant correlations with a nature relatedness ( $r=0.425, p<0.01$ ) and biospheric value ( $r=0.341, p<0.01$ ) construct. Furthermore, it exhibited predictive validity by predicting pro-environmental behaviour,  $\beta=0.243, b=0.176, t(413)=5.10, p<0.01$ . However, the Indonesian version of CCPS still needs to be tested and confirmed through various studies, considering the poor validity of the temporal dimension and the weak factor loading of the consequence dimension in Study 2.

**KEY WORDS**

climate change perception scale, cross-cultural adaptation, environmental value, Indonesian context, nature relatedness, pro-environmental behaviour, scale validation

## 1 | INTRODUCTION

Global warming and environmental degradation are reaching concerning levels with time, and the average surface temperature of the earth has experienced an increase of 1.18°C. On 3 July 2023, the U.S. National Oceanic and Atmospheric Administration reported that the earth's surface temperature reached a record high (CNBC Indonesia, 2023). Researchers concluded that this increase in temperature was an indication of global warming due to human activity. Several institutions predict that global warming will cause glaciers to disappear in Papua, Indonesia, before 2025 (USAID, 2017).

The situation becomes increasingly worrying in light of the fact that Indonesia is ranked first with the most citizens who do not believe in global warming (Milman & Harvey, 2019).

According to the World Resources Institute, Indonesia ranks third among countries with the highest deforestation rates, despite showing a decrease in those rates (Weisse & Goldman, 2019). The report states that Brazil and Indonesia account for 46% of the total deforestation on a global scale. Excessive exploitation of the environment is carried out to improve welfare without taking into account sustainability. Exploitation continues daily, causing environmental

problems to become increasingly complicated and complex. One of the challenges facing Indonesia is maintaining a balance between reducing greenhouse gas emissions and ensuring optimal economic growth to achieve its goal of becoming a developed country (The World Bank, 2023).

Most environmental issues involve human choices and actions, making psychology inherently responsible for understanding and formulating the occurrence of pro-environmental behaviour change (Mayer & Frantz, 2004; Steg & Vlek, 2009). The causes and detrimental impacts of those issues are extensively discussed in various disciplines and bodies of literature. Meanwhile, humans have a dual role in environmental issues as actors or sources of damage (IPCC, 2021; NASA, 2021) and recipients of adverse consequences (Cianconi et al., 2020). Efforts to mitigate the impacts of climate change should be based on human perception, behaviours, and well-being (Rajapaksa et al., 2018).

The strategies to address global warming and environmental degradation are quite challenging because they require the support of the general public. In addition, unpopular mitigation measures may face resistance when public support is weak and not prioritized (Rajapaksa et al., 2018). Recent studies show that Indonesia has a proportion of people who doubt human-caused climate change (18% of the population; Milman & Harvey, 2019). Understanding how members of society perceive the issue of global warming and environmental degradation is also important because greenhouse gas emissions are significant. To successfully implement efforts and strategies to mitigate global warming and ecological degradation, it is crucial to comprehend the underlying motivations to support the initiatives individually and collectively (Brügger et al., 2015).

One of the crucial factors in changing behaviour towards pro-environmental actions is climate change perception. This variable pertains to perceptions and beliefs regarding how human activities contribute to climate change and the associated consequences, locations, and timing of events (Brügger et al., 2015; van Valkengoed et al., 2021). Individuals who are sceptical towards climate change are less likely to adhere to environmentally friendly advice or respond to calls for action. Numerous studies have demonstrated a negative correlation between levels of scepticism and support for pro-environmental behaviours (Arbuckle et al., 2013; Leiserowitz, 2006).

One of the latest measurement tools for assessing the perception of climate change is the climate change perception scale (CCPS) developed by van Valkengoed et al. (2021). CCPS consists of five dimensions: perception of climate change reality, perception of climate change causes, perception of climate change consequences, spatial distance perception, and temporal distance perception. Perception of climate change reality refers to the extent to which an individual believes in the occurrence of climate change. Perception of climate

change causes represents an individual's beliefs about the factors driving climate change caused by human activity or natural causes. Perception of climate change consequences is an individual's perspective on the impacts of climate change. Spatial distance perception encompasses belief regarding the occurrence of climate change consequences in nearby or distant locations. Meanwhile, temporal distance perception refers to an individual's view regarding the immediate and future manifestation of climate change consequences.

The dimensions of climate change reality perception, perception of climate change causes, and perception of climate change consequences are based on various studies on denial or scepticism (van Valkengoed et al., 2021). Numerous studies on climate denial indicate that the first argument is to deny the occurrence of climate change. Due to mounting scientific evidence, denying the reality of climate change is becoming increasingly difficult to sustain. Denial strategies often involve shifting the focus towards denying the human contribution to climate change and downplaying the severity of its potential negative consequences on life (Björnberg et al., 2017). The dimensions of spatial and temporal distance perception are constructed based on the construal level theory (Trope & Liberman, 2010). According to this theory, two psychological distance dimensions are relevant to climate change perception. These include the perception of the consequences of climate change by individuals and the immediacy or future occurrence (McDonald et al., 2015).

CCPS has not gained widespread adoption and usage across different cultures, including Indonesia. In addition, no analyses have been conducted to adapt and validate CCPS in the Indonesian context. Indonesian society has a culture, habits, and experiences that differ from those in Western societies, where the CCPS was developed. As a developing country in a tropical region, Indonesia certainly has different natural conditions and lifestyles from those found in the West. Differences in literacy levels and economic welfare can also make a difference in the environmental concerns of Indonesian society (Liu & Mu, 2016). In addition, ecological management that is not adequate compared to Western countries creates uncertainty about how Indonesian people assess current environmental problems and climate change.

This study aims to adapt and assess the validity and reliability of CCPS within the cultural context of Indonesia. By translating and adapting the scale to the Indonesian language, it is anticipated that the exploration of climate change perception and pro-environmental behaviour will be enhanced, ultimately benefiting the broader community. This research consists of two different studies with varying samples. The first study adapts CCPS to the Indonesian language and then tests the construct validity and reliability of the Indonesian version using confirmatory factor

analysis (CFA). The second study confirms the factorial model and simultaneously highlights the convergent and predictive validity of CCPS.

Convergent validity is satisfied when scale correlates with other theoretically related constructs (Walton & Jones, 2018). The correlation between climate change perception and associated constructs, namely nature relatedness and biospheric value, was analysed to test the convergent validity. Based on the climate change risk perception model (CCRPM), one of the important factors determining a person's risk perception is the norms, values, and views about the environment held by the individual (Bradley et al., 2020; van der Linden, 2015). We speculate that nature relatedness can be categorized into these factors (Nisbet et al., 2009; Wang et al., 2019).

Nature relatedness, which consists of self, perspective, and experience dimensions, describes an individual's appreciation and understanding of the interconnectedness between humans and other living beings in the environment (Nisbet et al., 2009). Several studies show that individuals who have a strong sense of connectedness with nature tend to care more about and engage in behaviour that is beneficial to the environment (Forstmann & Sagioglou, 2017; Obery & Bangert, 2017; Sulphey & Faisal, 2021). This is because, cognitively and affectively, they consider that actions that damage the environment are the same as harming themselves (Schultz et al., 2004; Wang et al., 2019). Research by Nisbet et al. (2009) also shows that nature relatedness correlates with the level of consideration of future consequences (like risk perception) that a person has. Attachment to nature is also related to sensitivity to changes in the surrounding natural environment (Diakakis et al., 2021; Mayer et al., 2008; Tortosa-Edo et al., 2014). Thus, we predicted that individuals with higher levels of nature relatedness would exhibit stronger beliefs regarding the reality of climate change, its human-caused origins, and the presence of negative consequences (van Valkengoed et al., 2021).

Convergent validity is also seen through the correlation between climate change perception and environmental value, particularly biospheric. Environmental value is a general goal related to the environment that a person strives for or prioritizes (Bouman et al., 2018; Schwartz, 2012). The more an individual supports a particular value, the more likely he or she is to think and behave in line with it. The differences in value priorities determine individuals' beliefs, attitudes, and behaviours (de Groot et al., 2013). This study focuses on biospheric values, which are values regarding prioritization or concern for non-human nature and the biosphere itself (Bouman et al., 2018; van der Linden, 2017). We predict that individuals who strongly support biosphere values will have stronger pro-environmental beliefs and concerns about climate change.

Various studies show that biospheric value is closely related to a person's perception of climate change (Arnout, 2022; Bouman et al., 2020; Martin, 2023; Xie

et al., 2019). Based on the CCRPM, biospheric value is explicitly one of the determining factors for climate change perception (van der Linden, 2015). Climate change is related to the priorities or things that individuals with high biospheric value care most about (i.e., environmental conservation) because of its adverse impact on the natural environment (Martin, 2023). Therefore, individuals with high biospheric value may consider climate change more threatening than individuals with low biospheric value. In addition, individuals with high biospheric value will also feel personally responsible for taking action to mitigate climate change. We predict that individuals with high biospheric value will demonstrate stronger beliefs regarding the reality of climate change, its human origins, and the presence of negative consequences.

We also tested the predictive validity of the scale. This involves examining whether the scale can predict relevant outcomes or behaviours related to the investigated topic (Rosenthal & Rosnow, 2008). The variable to be measured is pro-environmental behaviour. Pro-environmental behaviour refers to actions carried out by individuals that benefit or harm the environment as little as possible (Steg & Vlek, 2009). Pro-environmental behaviour includes various direct and indirect efforts to prevent environmental damage and strive for coexistence in harmony with nature.

A high-risk perception, in this case, climate change perception, should encourage people to take various pro-environment actions to reduce these risks (van Valkengoed & Steg, 2019). In addition, environmental risk perception can also stimulate individuals' sense of urgency and responsibility to protect the environment and encourage more pro-environmental behaviour (Zeng et al., 2020). Various studies indicate that environmental awareness is the foundation for practicing environmentally friendly behaviour (Chen & Tung, 2014; O'Brien & Thondhlana, 2019; Su et al., 2021). Therefore, we suspect that climate change perception will predict a person's pro-environmental behaviour.

## 2 | STUDY 1

In this study, descriptive item analysis and CFA were conducted on a sample of the general population to identify the factor structure of CCPS under the proposal by van Valkengoed et al. (2021).

### 2.1 | Method

#### 2.1.1 | Participant

The participants comprised 358 males and females, with a mean age of 21.4 years ( $SD=2.9$ ). Participant recruitment used a convenience sampling technique

targeting university students in Semarang, the capital city of Central Java, as shown in Table 1.

## 2.1.2 | Materials and procedures

Data were collected online using Google Forms distributed through the study team's social media platforms for a wide reach of recruitment information. The sampling method used was convenience sampling. The questionnaire was adapted to the Indonesian language based on the original CCPS developed by van Valkengoed et al. (2021). The original scale consisted of 25 questions in five dimensions, with each item having a seven-point response scale ranging from “strongly disagree” to “strongly agree.” For all reversed items, reverse scoring was performed.

Before filling out this questionnaire, there was a screening question about whether the respondent believed climate change existed with a yes/no answer option. If the respondent answered No, he could not answer questions in the dimensions of causes, valence of consequences, spatial distance, and temporal distance. Consequently, these respondents were excluded from the analysis. We also included two bogus items in the questionnaire to ensure data quality. Participants who did not meet the research criteria and failed to answer the

bogus items correctly were removed from the analysis process.

The CCPS adaptation process was carried out in stages according to cross-cultural adaptation guidelines developed by Beaton et al. (2000), namely *translation* (T), *back translation* (BT) expert review, face validity test, and psychometric testing. To maintain the semantic and conceptual equivalence of measurement tools, the translated words should have the same meaning as in the original language, and all items must maintain a conceptual meaning aligned with the defined dimensions. This practice ensured consistency in interpreting and understanding the measurement tool across different languages or cultural contexts (Beaton et al., 2000).

Two translators and an independent back-translator conducted the translation process. They worked independently and produced two parallel translations of the same measurement tool to generate a consistent instrument version (Gudmundsson, 2009). Subsequently, an English-proficient environmental psychologist evaluated the final translated version, compared the result with the original instrument, and provided suggestions for improvement or correction. The validity and reliability testing was conducted using the CFA technique using Jamovi software. All analyses were estimated using the maximum likelihood procedure with robust standard errors. The fit indices and cut-off criteria used to assess the suitability between the hypothesized model and the data are The Comparative Fit Index (CFI)  $\geq 0.95$ , Tucker Lewis Index (TLI)  $\geq 0.95$ , The Normed Fit Index (NFI)  $\geq 0.90$ , The Goodness of Fit (GFI)  $\geq 0.95$ , The Root Mean Square Error of Approximation (RMSEA)  $\leq 0.05$ , and The Standardized Root Mean Square Residual (SRMR)  $\leq 0.08$  (Hu & Bentler, 1999). To compare the fit between several possible measurement models of the nature relatedness scale (NRS), the authors compared chi-squared and Akaike information criterion (AIC) values, where smaller values indicate a better fit (Byrne, 2010; Kline, 2016). The cut-off criterion used to assess composite reliability (CR) was greater than 0.7, and the average variance extracted (AVE) was greater than 0.4 (Hair Jr. et al., 2017).

TABLE 1 Demographic Data of Study 1 Respondents ( $n=358$ ).

Variables	Total	Percentage
Gender		
Male	107	29.9
Female	250	69.8
Did not choose	1	0.3
Age		
<20 year	79	22.1
20–30 year	277	77.4
>30 year	2	0.5
Education		
Junior – Senior High School	221	61.7
Diploma – Bachelor's degree	134	37.4
Master – Doctoral	3	0.9
Work		
Student	206	57.5
Employee	49	13.7
Self-employed	15	4.2
Does not work	8	2.3
No answer	80	22.3
Domicile		
Semarang	223	62.3
Outside Semarang	57	15.9
No answer	78	21.8

## 2.2 | Results

CFA analysis begins by analysing all CCPS items (25 items), but Model 1 did not meet all the established suitability criteria. The results of the analysis showed that Model 1 had the following values:  $\chi^2(265)=1270$ ,  $p<0.01$ , CFI=0.795, TLI=0.768, RMSEA=0.103 [90% CI 0.0973; 0.109], SRMR=0.098, and AIC=26,995. A conservative approach was used to abort the items with bad factor loading and maintain the original structure of CCPS, which had five factors.

Model 2 analysis had 15 items and met all the suitability criteria, namely  $\chi^2(75)=129$ ,  $p<0.01$ , CFI=0.980,



TLI=0.972, RMSEA=0.045 [90% CI 0.031, 0.058], SRMR=0.037, and AIC=15,965. In addition, a comparison of the chi-squared and AIC values between the two models showed that Model 2 was better with smaller chi-squared and AIC values and a better fit. The value of factor loading, validity, and reliability of Model 2 can be seen in Table 2. The dimensions of reality, causes, consequences, and spatial dimensions had good reliability and validity, indicated by the values of CR and AVE, which are greater than 0.7 and 0.4, respectively (Hair Jr. et al., 2017). The temporal dimension did not have good enough reliability and validity, even though it is not far from the specified cut-off.

Valid and reliable items based on CFA results were analysed to examine the correlations among the dimensions of CCPS and between the dimensions and the total scores. Table 3 showed that all dimensions of CCPS were positively correlated with the total CCPS score. Additionally, almost all dimensions were correlated except for the temporal dimension.

## 2.3 | Discussion

The first crucial step in Study 1 was the adaptation of CCPS to the Indonesian language. The guidelines for cross-cultural adaptation outlined by Beaton et al. (2000) were followed to ensure the semantic and conceptual equivalence of the measurement tool. Adhering to these guidelines made it possible to retain the conceptual meaning of each item, ensuring it did not deviate from the defined dimension. The two translators involved in the translation process had distinct backgrounds. The first possessed a psychology education background and a solid understanding of perception, while the second did not have a psychology background and was unfamiliar with these concepts. During the translation process, no significant differences were observed between the translations provided by the translators. Additionally, the expert did not make substantial corrections to the translated versions. These circumstances instilled confidence in the translated measurement tool's good semantic and conceptual equivalence.

The best model (Model 2) demonstrated good validity and reliability. The poor validity and reliability of the temporal dimension were attributed to the first item, which had a very low factor loading (loading=0.424). It was suspected that the item wording "It will be a long time before the consequences of climate change are felt" led to participant ambiguity in interpretation. This statement was interpreted negatively, suggesting that the impacts of climate change would only be felt in the distant future, without concern. Furthermore, the effects of climate change occur gradually and unnoticed, necessitating increased sensitivity and concern. We speculate that this ambiguity contributed to the item's poor

loading, affecting the internal consistency of the temporal dimension.

Almost all dimensions were correlated except the temporal dimension. The results of the analysis of Study 1 are consistent with the original study by van Valkengoed et al. (2021). The original study showed that the temporal dimension had low reliability and validity and the lowest correlation with other dimensions. This situation strengthens the indication that the low validity (AVE) of the temporal dimension may cause poor correlation results and might not describe the actual situation.

Even though one item in the temporal dimension had a less satisfactory factor loading, a decision was made to retain the item in the model. The first consideration was that the AVE and CR scores were not significantly far from the cut-off values, with  $CR > 0.7$  and  $AVE > 0.4$  (Hair Jr. et al., 2017). Additionally, the temporal dimension was maintained with three constituent items. According to Hair Jr. et al. (2017), the recommended minimum coverage for a construct was three items. Only using two items to measure a dimension would make the model vulnerable to estimation problems, especially with a small sample size. Moreover, deleting the temporal dimension also did not significantly increase the model's suitability or the reliability and validity of the other dimensions. Hence, the researchers decided to maintain this temporal dimension.

## 3 | STUDY 2

Study 2 was conducted to replicate and extend the findings from Study 1. CFA was performed on Model 2 using a different sample. Additionally, using the selected items from Study 1, the convergent and predictive validity of CCPS was assessed. Convergent validity was evaluated by examining the correlation between climate change perception, nature relatedness, and biospheric value. Then the predictive validity of CCPS was assessed by examining the effects of climate change perception on an individual's pro-environmental behaviour.

### 3.1 | Method

#### 3.1.1 | Participant

Study 2 comprised 415 individuals, including 77 males (18.6%) and 338 females (81.4%), with an average age of 19.2 years ( $SD=2.03$ ), as shown in Table 4. Convenience sampling was used to recruit participants.

#### 3.1.2 | Materials and procedures

Data collection was conducted online using Google Forms distributed through social media platforms. The

TABLE 2 Factor Loading, Validity, and Reliability of Model 2 in Study 1.

Items	Mean	SD	Loading	CR	AVE
<b>Reality (Realitas)</b>					
I believe that climate change is real ( <i>Saya percaya bahwa perubahan iklim itu nyata</i> )	6.25	0.89	0.581	0.826	0.621
The world's climate is changing ( <i>Iklim dunia ini sedang berubah</i> )	5.76	1.09	0.875		
Climate change is happening ( <i>Perubahan iklim sedang berlangsung</i> )	5.71	1.17	0.871		
<b>Causes (Penyebab)</b>					
Human activities are a major cause of climate change ( <i>Kegiatan manusia adalah penyebab utama perubahan iklim</i> )	5.63	1.33	0.789	0.891	0.732
Climate change is mostly caused by human activity ( <i>Sebab utama terjadinya perubahan iklim adalah kegiatan manusia</i> )	5.26	1.46	0.879		
The main causes of climate change are human activities ( <i>Penyebab utama perubahan iklim adalah kegiatan manusia</i> )	5.37	1.45	0.894		
<b>Consequences (Konsekuensi)</b>					
Overall, climate change will bring more negative than positive consequences to the world ( <i>Secara umum, perubahan iklim akan menyebabkan lebih banyak dampak negatif daripada positif ke dunia</i> )	5.50	1.40	0.791	0.771	0.543
Climate change will mostly have positive consequences ( <i>Perubahan iklim akan cenderung membawa dampak-dampak positif</i> ). (t)	5.09	1.38	0.473		
Climate change will bring about serious negative consequences ( <i>Perubahan iklim akan menyebabkan dampak-dampak negatif yang serius</i> )	5.46	1.44	0.883		
<b>Spatial (Spasial)</b>					
My local area will be influenced by climate change ( <i>Wilayah saya akan terdampak perubahan iklim</i> )	2.64	1.31	0.738	0.806	0.581
The region where I live will experience the consequences of climate change ( <i>Wilayah tempat saya tinggal akan mengalami dampak dari perubahan iklim</i> )	2.74	1.41	0.817		
Climate change will also influence the place where I live ( <i>Perubahan iklim juga akan mempengaruhi tempat saya tinggal</i> )	2.60	1.32	0.729		
<b>Temporal (Temporal)</b>					
It will be a long time before the consequences of climate change are felt ( <i>Butuh waktu yang lama untuk bisa merasakan dampak-dampak perubahan iklim</i> ). (r)	4.00	1.57	0.424	0.647	0.390
Only future generations will experience the consequences of climate change ( <i>Hanya generasi-generasi masa depan yang akan mengalami dampak-dampak perubahan iklim</i> ). (r)	3.12	1.63	0.703		
The consequences of climate change will only be experienced in the distant future ( <i>Dampak-dampak perubahan iklim hanya akan dialami jauh di masa depan</i> ). (t)	3.21	1.79	0.705		

Note: The total score is obtained by adding up the scores of all dimensions; r = reverse items.

TABLE 3 Correlation between CCPS Dimensions ( $N=358$ ).

Variables	1	2	3	4
1. CCPS-Reality				
2. CCPS-Causes	0.507***			
3. CCPS-Consequences	0.570***	0.682***		
4. CCPS-Spatial	0.682***	0.570***	0.588***	
5. CCPS-Temporal	0.166***	0.018**	0.144***	0.198***

Note: \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ .

TABLE 4 Demographic Data of Study Respondents ( $n=415$ ).

Variable	Total	Percentage
Gender		
Male	77	18.6
Female	338	81.4
Age		
<20 year	251	60.5
20–30 year	162	39
>30 year	2	0.5
Education		
Junior – Senior High School	395	95.2
Diploma – Bachelor's degree	19	4.6
Master – Doctoral	1	0.2
Work		
Student	375	90.4
Employee	27	6.5
Self-employed	3	0.7
Does not work	10	2.4
Domicile		
Semarang	399	96.1
Outside Semarang	16	3.9

sampling method used is convenience sampling. The CCPS questionnaire was based on the valid and reliable items from Study 1, totalling 15 items. We used the same procedures as Study 1, with a screening question and two bogus items.

CCPS consisted of five dimensions, with each item having a seven-point response scale ranging from “strongly disagree” to “strongly agree.” The NRS (Nisbet et al., 2009) was adapted to the Indonesian language by Adiwena and Djuwita (2022) to measure nature relatedness. The NRS consisted of 10 items measuring three dimensions: self, perspective, and experience. An example of a NRS question is “My relationship to nature is an important part of who I am (*hubungan saya dengan lingkungan alam merupakan bagian penting dari diri saya*).” Each item had a six-point response scale ranging from “strongly inappropriate” to “strongly appropriate” and was presented randomized.

TABLE 5 Factor Loading, Validity, and Reliability in Study 2.

Dimension	Factor loading	CR	AVE
CCPS-Reality	0.540–0.868	0.774	0.542
CCPS-Causes	0.699–0.876	0.845	0.647
CCPS-Consequences	0.422–0.836	0.714	0.471
CCPS-Spatial	0.735–0.865	0.843	0.642
CCPS-Temporal	0.594–0.836	0.680	0.483

Biospheric value was measured with the Environmental Portrait Value Questionnaire (Bouman et al., 2018), adapted to the Indonesian language by Tamar et al. (2020). An example of an Environmental Portrait Value Questionnaire question is “It is important to me to protect the environment (*penting bagiku untuk menjaga lingkungan*).” The biospheric value dimension consisted of four items with five answer points, ranging from “strongly disagree” to “strongly agree,” and were presented randomized.

Pro-environmental behaviour was assessed with a 12-item scale from Begum et al. (2021) and was adapted to the Indonesian context. An example of a pro-environmental behaviour question is “I buy products in refillable packages (*saya membeli produk dalam kemasan yang dapat diisi ulang*).” Each item had a six-point response scale ranging from “strongly inappropriate” to “strongly appropriate” and was presented randomized. Data analysis was performed using Jamovi software.

## 3.2 | Results

Like Study 1, the CFA analysis of Model 2 also meets all the goodness-of-fit criteria, namely  $\chi^2(65)=117$ ,  $p < 0.01$ , CFI=0.980, TLI=0.972, RMSEA=0.043 [90% CI 0.031, 0.056], SRMR=0.034, and AIC=16,403. The factor loading values, validity, and reliability can be seen in Table 5. The analysis results indicate that the reality, causes, consequences, and spatial dimensions have good reliability and validity, as indicated by CR and AVE values greater than 0.7 and 0.4 (Hair Jr. et al., 2017). However, the temporal dimension does not have good reliability and validity.

TABLE 6 Correlation between CCPS Dimensions, NR Dimensions, and Biospheric Value ( $N=415$ ).

Variable	1	2	3	4	5	6	7	8
CCPS-Reality								
CCPS-Causes	0.530***							
CCPS-Consequence	0.557***	0.590***						
CCPS-Spatial	0.662***	0.477***	0.568***					
CCPS-Temporal	0.177***	0.036	0.136**	0.145**				
NR-Self	0.435***	0.305***	0.263***	0.374***	0.118*			
NR-Perspective	0.351***	0.326***	0.258***	0.253***	0.076	0.572***		
NR-Experience	0.330***	0.228***	0.205***	0.311***	0.040	0.690***	0.472***	
Biospheric value	0.371***	0.275***	0.241***	0.298***	0.038	0.599***	0.570***	0.488***

Note: \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ .

The analysis results indicate that CCPS is significantly correlated with NRS ( $r=0.425$ ,  $p < 0.01$ ) and biospheric value ( $r=0.341$ ,  $p < 0.01$ ). Moreover when examined based on the constituent dimensions, CCPS dimensions are positively correlated with NRS dimensions and biospheric value. Table 6 showed the correlation between CCPS dimensions with NRS dimensions and biospheric value. The results support Study 1, in which the temporal dimension did not correlate with NRS dimensions and biospheric value. This shows that CCPS has good convergent validity.

The regression analysis showed that CCPS significantly predicted individuals' pro-environmental behaviour,  $\beta=0.243$ ,  $b=0.176$ ,  $t(413)=5.10$ ,  $p < 0.01$ . Climate change perception also accounted for a significant proportion of the variance in the scores of pro-environmental behaviour,  $R^2=0.06$ ,  $F=26.0$ ,  $p < 0.01$ .

### 3.3 | Discussion

CFA results with a different sample/dataset in Study 2 showed similarities with CFA in Study 1. The model tested in Study 2 met the established criteria for GFI. The validity and reliability of most dimensions of this model were considered good. Like Study 1, the temporal dimension remained the only dimension with relatively lower reliability ( $CR=0.680$ ). The consistent CFA results with a different sample/dataset indicate the robustness of the findings for the Indonesian version of CCPS.

The results of Study 2 support our hypothesis and demonstrate that CCPS has good convergent validity. This is indicated by the significant correlation between CCPS and NRS ( $r=0.425$ ,  $p < 0.01$ ), as well as CCPS and biospheric value ( $r=0.341$ ,  $p < 0.01$ ). This study confirmed a positive relationship between climate change perception and environmentally friendly attitudes (i.e., nature relatedness and biospheric value). The analysis shows that most dimensions are positively correlated with each other. The temporal dimension remains the only dimension of CCPS that does not correlate with all dimensions of NRS.

Nature relatedness describes the appreciation and understanding of the interconnectedness between humans and other living beings in the environment (Nisbet et al., 2009). Nature relatedness goes beyond a person's inclination to engage in environmentally supportive activities or enjoy the beauty of nature. Furthermore, it represents a comprehension and appreciation of the importance of all dimensions of nature, including recognizing climate change as a real phenomenon caused by humans with negative environmental consequences. This study supports the notion that individuals with higher levels of nature-relatedness will have higher levels of climate change perception. This is because, cognitively and affectively, they are more sensitive to changes in the natural environment around them and consider any actions that damage the environment to be the same as harming themselves (Diakakis et al., 2021; Wang et al., 2019).

Moreover, this research supports previous studies showing that biospheric value is closely related to a person's perception of climate change (Bouman et al., 2020; Martin, 2023; Xie et al., 2019). Climate change is directly related to the priorities or things that individuals with high biospheric value care about most, so they will perceive climate change as being more threatening than will individuals with low biospheric value. In addition, individuals with high biospheric value will also feel more personally responsible for taking action to mitigate climate change.

Study 2 also demonstrates that CCPS has good predictive validity, which is indicated by the significant regression between CCPS and pro-environmental behaviour,  $\beta=0.243$ ,  $b=0.176$ ,  $t(413)=5.10$ ,  $p < 0.01$ . This study supports the notion that individuals who perceive climate change as real, caused by human activities, and having negative consequences in the present and near future display positive attitudes and behaviour towards the environment. These results are consistent with previous studies conducted in this field (Seo & Kudo, 2022; Soares et al., 2021; Zhou et al., 2020). According to the Extended Parallel Processing Model (EPPM), a person's environmentally friendly behaviour is influenced by the perception of vulnerability and the severity of



environmental damage. Individuals who perceive the current ecological threat as severe and personally relevant are more inclined to engage in environmentally friendly behaviour (Adiwena et al., 2020). Therefore, it can be concluded that the CCPS also has good predictive validity.

#### 4 | GENERAL DISCUSSION

This study examined the validity of the Indonesian version of CCPS, following the factorial structure of the original, using a sample from Indonesia from two different studies with varying samples. The first study adapts CCPS to the Indonesian language and then tests the construct validity and reliability of the Indonesian version using CFA. The second study confirms the factorial model and simultaneously tests the convergent and predictive validity of CCPS. The results indicated that the Indonesian version had the same factorial structure as the original, consisting of five factors, and demonstrated satisfactory reliability and validity. In Study 1, two models of the Indonesian version were tested, Models 1 and 2. CFA was conducted for Model 1 by including all translated items (25 items), while Model 2 was a modification of Model 1, removing items with poor performance (15 items). The comparison between the two models showed that Model 2 exhibited a better fit since all the goodness-of-fit criteria were met. Therefore, it can be concluded that the Indonesian version of CCPS Model 2 consisted of 15 items, with three for each dimension.

Based on CFA results, the dimensions of reality, causes, consequences, and spatial had good reliability and validity, as indicated by the CR and AVE values exceeding the thresholds recognized by consensus: CR  $\geq 0.7$ , AVE  $\geq 0.5$  (Hair Jr. et al., 2017). Meanwhile, the temporal dimension had relatively lower AVE and CR values. Since the AVE and CR scores were not far from the cut-off, three constituent items were maintained as suggested by Hair et al. (2010), and the temporal dimension of the three items was retained. According to Kline (2016), models having factors with only two indicators were prone to estimation issues, especially when the sample size was small. In the original study by van Valkengoed et al. (2021), the temporal dimension also had the lowest reliability and validity.

The results indicated that CCPS also had good convergent validity, achieved when the scale was correlated with other theoretically related constructs (Walton & Jones, 2018). In this study, there was a good correlation between the CCPS, NRS, and biospheric value. The results of this study also support various previous studies. Nature relatedness indicates an individual's appreciation and understanding of the interconnectedness between humans and other living beings (Nisbet et al., 2009). Forging a connection with nature transcended a mere inclination to partake in environmentally supportive

endeavours. It encompassed a profound comprehension of and sincere appreciation for the intrinsic value of every facet of nature. Therefore, the level of nature relatedness was directly proportional to the reality of climate change, its anthropogenic origins, and the adverse consequences unfolding in the present and future (van Valkengoed et al., 2021). On the other hand, individuals with high biospheric value may see climate change as something that is more threatening and also feel personally responsible for taking action to mitigate climate change.

CCPS also demonstrated good predictive validity, as indicated by the positive relationship with pro-environmental behaviour. The reality of climate change, anthropogenic origins, and immediate and impending negative consequences affected the propensity to adopt positive attitudes towards environmentally friendly behaviours, such as minimizing the use of plastic bags. These findings aligned consistently with numerous studies (Seo & Kudo, 2022; Soares et al., 2021; Zhou et al., 2020). According to the EPPM, individuals' pro-environmental behaviour is determined by their perception of environmental damage (Adiwena et al., 2020). Meanwhile, individuals engaged in pro-environmental behaviour when the environmental threat became severe.

Studies 1 and 2, conducted with different samples/datasets, indicated that CFA results for the Indonesian version of CCPS were robust. However, as a relatively new measurement tool yet to be widely used and adapted, this scale still needs further development. The tool should be tested with different samples from diverse cultures. By adopting this approach, studies focusing on climate change perception and pro-environmental behaviour within Indonesian society can attain greater depth and generate more substantial benefits.

Indonesia, as one of the lungs of the world, is certainly expected to be more serious in addressing climate change. With demographic, cultural, and natural conditions that are different from Western countries, we need a measuring tool that is valid and suitable for use in the Indonesian context. Hopefully, this research will contribute to environmental psychology and help to develop greater awareness of the environment and solutions in Indonesia. Using this scale, researchers can start researching pro-environmental behaviours that can be promoted by considering the important role of a person's climate change perception. In this way, the problem of climate change can be gradually overcome. Considering the important role of climate change perception, further research also needs to explore various variables that can influence climate change perception so that more people understand and care about climate change. We hope in the future the problem of climate change can be mitigated and society and stakeholders can work together to slow global warming and climate change.

The results of adapting the Indonesian version of CCPS still need to be tested and confirmed by other studies,

considering the poor validity of the temporal dimension and the weak loading of the consequence dimension factors in Study 2. This research has several limitations, such as the relatively young age of the respondents, who were largely students, the predominance of women among the respondents, and the fact that most respondents reside in Semarang city. The convenience sampling technique makes this research sample less representative of the Indonesian context. Given the broad and diverse demographic and geographic conditions involved, further research needs to ensure the quality of the CCPS measuring instrument under more diverse and representative sample conditions.

## 5 | CONCLUSION

In conclusion, the Indonesian version of CCPS accurately and reliably measured perception of climate change. This study showed that the Indonesian version had the same factorial structure as the original, consisting of five dimensions: perception of climate change reality, climate change causes, consequences, spatial distance, and temporal distance. CCPS also exhibited good convergent validity, as indicated by significant correlations with other constructs, such as nature relatedness and biospheric value. Additionally, it demonstrated good predictive validity, as evidenced by substantial association with pro-environmental behaviour.

The study also indicated that the Indonesian version of CCPS had some limitations, particularly regarding the reliability and validity of the temporal dimension. Therefore, further development and testing are needed regarding the adapted items/constructs and more diverse samples to obtain a more valid and reliable Indonesian version of CCPS for future use.

### AUTHOR CONTRIBUTIONS

**Bartolomeus Yofana Adiwena:** Conceptualization; formal analysis; funding acquisition; methodology; software; supervision; writing – original draft. **Maria Bramanwidyantari:** Conceptualization; data curation; funding acquisition; investigation; project administration; resources; visualization; writing – review and editing.

### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### PRE-REGISTRATION STATEMENT

None of the studies were preregistered.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author. The

data are not publicly available due to privacy or ethical restrictions.

### RESEARCH MATERIALS AVAILABILITY STATEMENT


The research materials are not shared.

### ETHICS STATEMENT

This study was approved by the Research Ethics Commission with Research Ethics Approval No. 019/B.7.5/FP.KEP/III/2022.

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