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Abstract

There is growing interest in climate change education, however there are very limited tools in elementary and secondary level to measure students' understanding. Departing from this need, this study aimed to adapt the Climate Change Stages of Change Questionnaire into Turkish and examine its validity and reliability. The adaptation process stated with the International Test Commission guidelines and involved expert consultation, forward-backward translation, and pilot testing. The latter phase included large scale data collection and the questionnaire was distributed to randomly selected middle school students in three different Turkish cities. 493 sixth- and seventh-grade students participated in the large-scale data collection. Confirmatory Factor Analysis supported the original five-factor structure, yielding acceptable fit indices (e.g., RMSEA = 0.075; CFI = 0.915). Internal consistency reliability ranged from acceptable to high across most subscales, although the two-item contemplation subscale showed a lower alpha value. Results indicate that the Turkish version of the CCSOCQ is a valid and reliable tool for assessing students' behavioral change stages regarding climate action. The scale can serve as a valuable resource in designing targeted climate education interventions and evaluating their impact on students' progression toward sustainable behaviors.

Introduction

Climate change stands as the most critical threat facing humanity today, demanding immediate and decisive action. The increasing frequency of climate-related events poses significant challenges for government agencies in making strategic decisions related to economic development. Governments and policymakers worldwide have increasingly taken proactive steps and formulated strategies to address climate change (Cifuentes-Faura, 2022; Yang et al., 2023). On the other hand, Chinowsky et al. (2011) stated that governments face when factoring long-term climate impacts into infrastructure planning. Research on climate change education remains a multifaceted area, with much of the work concentrated in high-income countries. For research efforts to be effective, they should assess training programs and identify best practices. Nepraš et al. (2022) noted that climate change research is published across a variety of journals, with the United States leading the field. Their study also revealed that commonly explored themes include knowledge, behaviors, actions, experiences, and attitudes. While these actions

might seem minor, they can collectively generate significant positive outcomes. Nonetheless, some people remain unaware of the importance of individual action (Tourlioti et al., 2024), or perceive climate change as a distant threat that won't affect them personally in the near future (Hulkkonen et al., 2024). Although many recognize that climate change already has local and immediate consequences (Baltikian et al., 2025; Lambert & Bleicher, 2017; Gebeyehu et al., 2024), this awareness doesn't always lead to behavioral change (Van Valkengoed et al., 2023). Environmental behaviors and perspectives are shaped by a range of cognitive, psychological, and cultural factors (Situmorang et al., 2023), and their responses to climate change often vary depending on their regional experiences (Brügger et al., 2021).

Age plays an important role in shaping individuals' perceptions and responses to climate change. Clayton et al. (2023) analyzed responses from individuals aged 16 to 25 across ten countries to investigate how climate change concern varies according to age and gender. Clayton et al. found that, although men tend to express more optimism, women report higher levels of concern and negative emotions. Older participants within the age range showed greater anxiety and distress. Countries such as Nigeria, India, and the Philippines reported more pronounced psychological impacts, offering insights into the global patterns of climate-related anxiety. In another study, Skeiryte et al. (2022) reported that young people generally show higher awareness and concern about climate change, they are often less likely to engage in environmentally responsible actions or assume responsibility. Lin and Fung (2024) added that young people express greater concern about the climate crisis, older adults tend to adopt environmentally friendly behaviors more consistently.

Social problems often arise from the cumulative effect of similar behaviors repeated by many individuals. Correspondingly, when individuals alter their behaviors, it can lead to widespread positive change (Glenn, 2004). However, changing ingrained behaviors can be difficult, even when the long-term benefits are well understood (Duckworth & Gross, 2020). This challenge is also evident in the context of climate-related behavior. Although there is general awareness in society about the causes and risks of climate change, this awareness does not always lead to action. Habitual routines and social norms often act as barriers that hinder behavioral change (Van Valkengoed et al., 2024), delaying or even preventing individuals from engaging in environmentally responsible practices (Hoffman et al., 2024). To address this issue, strategies such as climate education, financial incentives for eco-friendly technologies, and behavioral interventions aimed at sustaining environmental actions have been recommended (Stankuniene et al., 2020). These approaches outline a progression: from raising awareness to initiating behavioral change, followed by efforts to maintain these behaviors over time.

People perceive the threat of climate change in different ways. Research indicates that climate risk perception varies based on age, knowledge, past experiences, and sociocultural background (Sun & Han, 2018; Van der Linden, 2015). Often, climate change is seen as a distant issue, both in time and geography. However, as individuals become more aware of its local and immediate impacts, their sense of environmental responsibility tends to grow (Spence et al., 2012). While this heightened awareness can sometimes cause anxiety or distress, such emotional responses may also prompt individuals to take adaptive actions (Clayton & Karazsia, 2020; Gianfredi et al., 2024). Therefore, awareness is a crucial first step toward meaningful action. The literature highlights a strong link between awareness and behavioral engagement in climate action (Filho et al., 2023). For

example, Calculli et al. (2021) found that young people who understand the consequences of climate-induced disasters are more inclined to adopt sustainable lifestyles. In Türkiye, research has shown that awareness and concern about climate change positively influence individuals' optimism about preventing it (Tümer et al., 2024). Similarly, Gündoğdu et al. (2025) concluded that individuals with greater concern and knowledge tend to display higher levels of climate change awareness.

Education plays a vital role in cultivating climate awareness (Ghosh et al., 2016). While many middle school students recognize climate change as a significant issue, they often lack awareness of how their personal actions can influence its trajectory (Özdem et al., 2014). Moreover, having knowledge does not always lead to action. For instance, Taurinen et al. (2024) observed that although many young people possess strong knowledge of climate change, they struggle to participate in concrete climate actions. Given its scientific and social dimensions, climate change education in schools should encourage students to critically engage with both aspects (Trott & Weinberg, 2020). As part of science education, climate topics can help students understand that meaningful responses require collective social action (Clark, 2024). In this sense, science education goes beyond imparting cognitive knowledge—it holds significant potential to foster active engagement (Kang & Tolppanen, 2024).

Understanding the behavioral patterns of younger generations is particularly important. Given the expected intensification of climate change impacts in the future, understanding how young individuals behave in this context is crucial for promoting sustainable individual and collective actions (Bray & Nakata, 2024; Marpa, 2020; McGovern & Cuevas, 2025; Samur & Akman, 2023). This study aimed to adapt the Climate Change Stages of Change Questionnaire (Inman et al., 2022) for use with Turkish middle school students and to examine its validity and reliability. Currently, no similar tool exists in the Turkish context to assess students' behavioral changes related to climate change. Understanding how individuals—particularly students—navigate behavioral change processes in response to climate change is essential for designing effective interventions (Inman et al., 2022). Exploring the behavioral tendencies of middle school students, who represent both the current and future population, is particularly timely and significant for Türkiye, where climate change is an urgent issue.

This study aimed to adapt the Climate Change Stages of Change Questionnaire developed by Inman et al. (2022) for Turkish middle school students. The questionnaire allows researchers to assess climate-related behavior by examining individuals' progression through each stage of behavioral change. However, because the original tool was developed in a different socio-cultural context, it is essential to evaluate its functionality and validity within the Turkish context. To date, no such adaptation or validation study has been conducted in Türkiye. This research aims to address that gap by assessing the questionnaire's validity and reliability in a Turkish middle school sample.

Method

This research employed a mixed-methods approach. In the initial phase, qualitative data were used to inform the development of the preliminary version of the scale. This qualitative component aimed to ensure the semantic, conceptual, and cultural suitability of the translated items and the scale overall. Data for this phase were gathered through interviews with subject-matter experts and translation specialists. The data were analyzed using content

analysis, and item-level revisions were reported based on expert feedback. Following this, quantitative analyses were conducted to test the construct validity and reliability of the scale, leading to the final version (Creswell & Plano Clark, 2018). The study sample consisted of 493 sixth- and seventh-grade students from randomly selected public middle schools in three different cities in Türkiye (see Table 1). These cities were selected based on the researchers' places of residence. Prior to school visits, researchers obtained official permission through a centralized assignment system, which randomly designated participating schools. A total of 12 schools across the three cities were assigned.

Table 1. Demographic Information of Participants

		Frequency	Percent (%)
Gender	Female	252	51.02
	Male	241	48.98
Grade	6th	274	55.49
	7th	219	44.51

Instrument

This study focused on validating the factorial structure of the Climate Change Stages of Change Questionnaire (CCSOCQ), originally developed by Inman et al. (2022). Original version of CCSOCQ was designed to assess the process of behavioral change related to climate action across different stages and was initially validated with both adult ($N = 347$) and adolescent ($N = 3469$) samples. The 15-item scale measures individuals' attitudes and readiness to adopt climate-friendly behaviors, based on the Transtheoretical Model (Prochaska & DiClemente, 1983). The model includes five stages: Precontemplation, Contemplation, Preparation, Action, and Maintenance. In its original validation, the original CCSOCQ demonstrated strong internal consistency for the adolescent sample, with an overall Cronbach's alpha of .82 (Inman et al., 2022). Subscale reliability coefficients were all above the acceptable threshold of .60, indicating adequate reliability: Precontemplation ($\alpha = .82$), Contemplation ($\alpha = .60$), Preparation ($\alpha = .79$), Action ($\alpha = .81$), and Maintenance ($\alpha = .74$).

Adaptation Process

The adaptation of the CCSOCQ into Turkish was carried out in accordance with the procedures outlined in the International Test Commission (ITC) Guidelines for Translating and Adapting Tests (International Test Commission, 2017). During the preparation phase (see Figure 1), it was determined that the CCSOCQ was suitable for adaptation to the Turkish middle school context, given the alignment between the original adolescent sample and the climate-related behaviors relevant to this population. Permissions for the adaptation were obtained from both the original authors of the scale and the institutional ethics committee. An interdisciplinary working group—comprising academics and graduate students from Science Education and Mathematics Education—was formed to oversee the process.

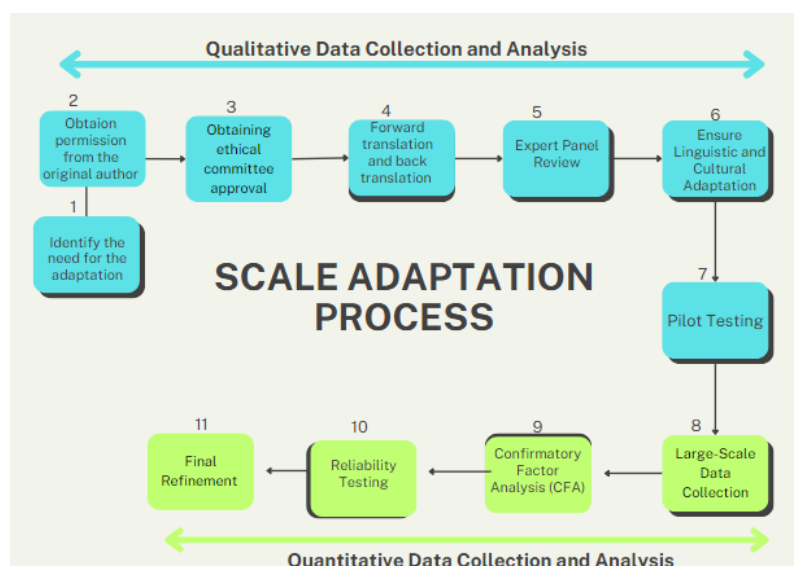


Figure 1. Research Design and Scale Adaptation Process

CCSOCQ (Inman et al., 2022) was originally developed and administered in Portuguese and later translated into English for publication. As the structure and content of the scale were shaped by the Portuguese education system and climate policies, it is recommended that the instrument be adapted and validated for use in different populations and cultural contexts. Within the scope of this study, the CCSOCQ was first translated into Turkish. The translation process was conducted in multiple phases to ensure linguistic accuracy and cultural relevance. Initially, two experts fluent in English, Portuguese, and Turkish independently translated the original (English) and the developed (Portuguese) versions of the questionnaire into Turkish. Both of these experts are academics who defined their postgraduate education abroad and have academic text translation experiences in the field of Science Education. These two Turkish versions were then compared, and a consensus was reached through discussion to ensure conceptual equivalence and semantic clarity.

The CCSOCQ was later translated into English for dissemination. Since the scale reflects educational and environmental priorities specific to the Portuguese context, it was necessary to adapt and validate it for use in other cultural and linguistic settings. In this study, the CCSOCQ was first translated into Turkish through a multi-phase process to ensure both linguistic precision and cultural relevance. Two experts fluent in English and Turkish, as well as fluent in Portuguese and Turkish—both academics with international postgraduate experience and expertise in academic translation independently translated both versions into Turkish. The two versions were then compared and harmonized through discussion to achieve semantic clarity and conceptual alignment. Next, a back-translation was performed. An independent bilingual translator, unfamiliar with the original scale, translated the Turkish version back into English. The back-translated version was compared with the original to identify and rectify any linguistic or meaning discrepancies. In the final step, the interdisciplinary expert group reviewed the Turkish translation for consistency with the original items, with particular focus on meaning, linguistic accuracy, and cultural appropriateness. This careful review ensured that the adapted version retained the integrity of the original instrument while being contextually appropriate for Turkish middle school students.

A pilot study was also conducted with a group of middle school students to evaluate the clarity, comprehensibility,

and overall suitability of the Turkish version of the CCSOCQ items for the target age group. This phase assessed students' understanding of key concepts, and appropriateness of the language used. The pilot study's insights led to the refinement of the instrument and the creation of the version used in subsequent factor analyses.

Statistical Analyses

In this study, both validity and reliability analyses were conducted during the adaptation process of the scale. The study conducted validity and reliability analyses on a scale adaptation process using IBM SPSS Statistics 26.0. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity used to assess the dataset's suitability for factor analysis. Bartlett's test assessed if there were strong enough inter-item correlations for factor analysis, while the KMO test assessed sample adequacy. The dataset fulfilled the statistical assumptions required for additional factor analysis. When adapting a theoretically grounded and previously validated instrument to a new language or culture, it is methodologically acceptable to apply Confirmatory Factor Analysis (CFA) without first conducting Exploratory Factor Analysis (EFA) (Brown, 2015; Byrne, 2016). Unlike EFA, which is data-driven, CFA is a hypothesis-driven analysis that tests the fit of a pre-defined model, allowing researchers to examine how well the observed data align with the original theoretical structure.

CFA was conducted using LISREL 9.0 software. Model fit was evaluated using a range of indices such as the Chi-square (χ^2) test, the Chi-square to degrees of freedom ratio, RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), and SRMR (Standardized Root Mean Square Residual). This methodological approach is commonly used in cross-cultural validation research and offers strong support for the instrument's structural equivalence (Vandenberg & Lance, 2000). The reliability of the adapted scale was assessed using Cronbach's alpha (α) coefficient, calculated for each subdimension and for the total scale using SPSS software. The results demonstrated acceptable internal consistency, indicating that CCSOCQ is a valid and reliable measurement tool for application within the Turkish sample.

Results

This section outlines the findings related to the Turkish adaptation of the CCSOCQ, including the outcomes of KMO and Bartlett's tests, as well as the results of CFA, based on responses from 493 students. The KMO value was found to be 0.855, which, according to Kaiser's (1974) criteria, falls within the good a good level of sampling adequacy. Bartlett's Test of Sphericity produced a significant result ($\chi^2 = 2175.268, p < .001$), confirming that the correlation matrix was not an identity matrix and that the variables are sufficiently interrelated to justify the use of factor analysis (Field, 2018). Then CFA was performed to assess the extent to which the theoretically proposed factor structure fit the observed data. The model fit indices obtained as a result of CFA are presented in Table 2.

The statistical analyses to evaluate the structural validity of the adapted CCSOCQ were conducted using LISREL 9.0 software, a widely recognized tool for structural equation modeling. This software was selected due to its robust capabilities in CFA, particularly in handling complex latent variable models with multiple indicators. The use of LISREL ensured precise estimation of the measurement model parameters and provided clear visual

representations of both standardized solutions and t-values, which facilitated the interpretation of model adequacy in relation to theoretical expectations.

Table 2. CFA Model Fit Indices

Index	Good Fit Criterion	Acceptable Fit Criterion	Research Findings	Results
X ² / sd	The value found must be statistically insignificant and X ² / sd < 4.		306.544/80= 3.83	Acceptable Fit
p	0.05 ≤ p ≤ 1	0.01 ≤ p ≤ 0.05	0.000	Acceptable Fit
RMSEA	0 ≤ RMSEA ≤ .05	.05 < RMSEA ≤ .08	0.0758	Acceptable Fit
SRMR	0 ≤ SRMR ≤ .05	.05 < SRMR ≤ .10	0.0606	Acceptable Fit
CFI	.95 ≤ CFI ≤ 1.00	.90 ≤ CFI < .95	0.915	Acceptable fit
GFI	.90 ≤ GFI ≤ 1.00	.85 ≤ GFI < .90	0.924	Good fit
AGFI	.90 ≤ AGFI ≤ 1.00	.85 ≤ AGFI < .90	0.887	Acceptable Fit
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI < .95	0.916	Acceptable fit
PGFI	.95 ≤ PGFI ≤ 1.00	.50 ≤ PGFI < .95	0.616	Acceptable fit
RFI	0.90 < RFI ≤ 1.00	0.85 < RFI ≤ 0.90	0.855	Acceptable fit
PNFI	.95 ≤ PNFI ≤ 1.00	.50 ≤ PNFI < .95	0.677	Acceptable fit

When examining the t-values of the structural model (see Figure 2), the absence of any statistically non-significant path coefficients indicates that the overall model fit is acceptable.

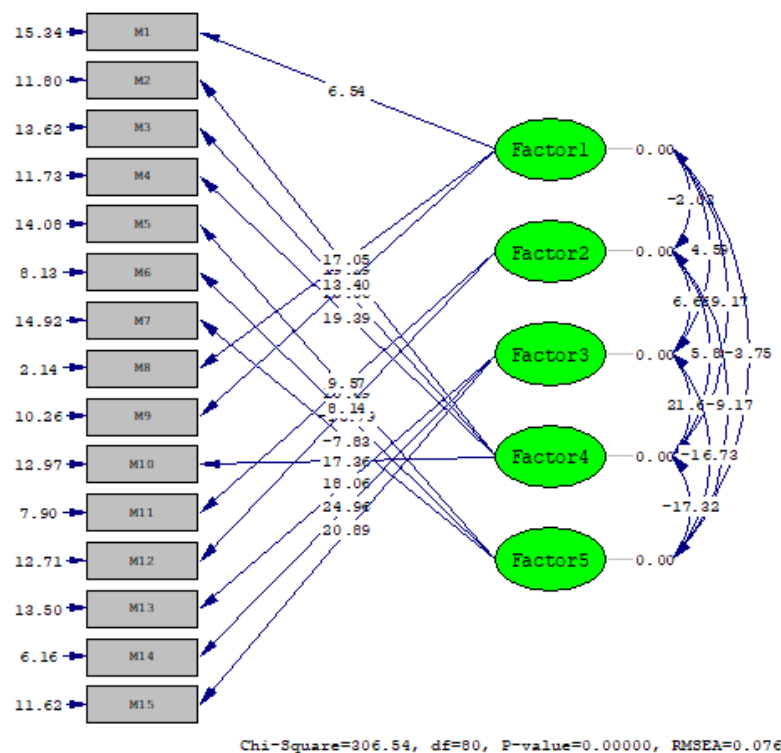


Figure 2. t-Values of the Adapted CCSOCQ Scale

Furthermore, the model's standard solution (see Figure 3) also supports this adequacy. In evaluating model fit, several fit indices were considered, including χ^2/df , RMSEA, CFI, GFI, AGFI, and SRMR (Byrne, 2016; Kline, 2015). The fit indices obtained from the analysis indicated that the model demonstrated generally acceptable levels of fit ($\chi^2/df = 3.83$, RMSEA = 0.075, CFI = 0.915, GFI = 0.924, AGFI = 0.887, SRMR = 0.0606). These values were interpreted according to the fit criteria reported by İlhan and Çetin (2014), supporting the conclusion that the factor structure of the scale is valid in the context of the target culture.

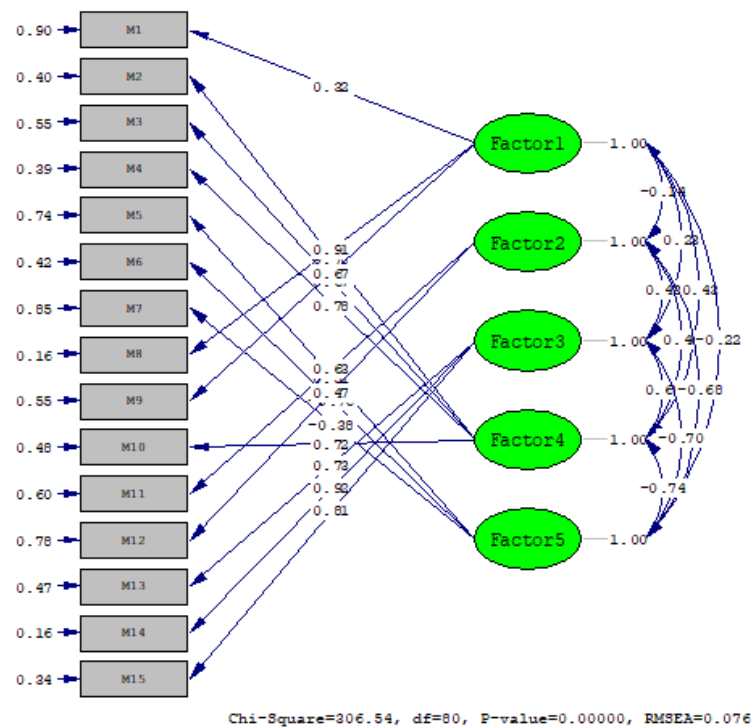


Figure 3. Standardized Solution of the Adapted CCSOCQ Scale

Reliability of the Scale

The total scale demonstrated acceptable internal consistency, with an overall Cronbach's alpha value of .738. While a threshold of .70 is widely considered acceptable for established instruments, values above .50 may be considered sufficient in the early phases of scale adaptation, especially in exploratory research or when the instrument is adapted to a new linguistic or cultural context (Nunnally & Bernstein, 1994). This is supported by studies discussing that subscales with fewer items may have lower reliability coefficients, particularly when these items attempt to represent broader latent constructs (Ziegler et al., 2014).

In line with the original structure of the scale, CFA supported a five-factor model, composed of the subscales Precontemplation (including items 1, 8, and 9), Contemplation (items 11 and 12), Preparation (items 13, 14, and 15), Action (items 2, 3, 4, and 10), and Maintenance (items 5, 6, and 7). The internal consistency coefficients for these subscales were as follows: Preparation demonstrated strong reliability with $\alpha = .820$, Action presented acceptable reliability with $\alpha = .789$, and Maintenance also yielded a satisfactory level of $\alpha = .738$. The

Precontemplation subscale displayed a reliability of $\alpha = .532$, which, while lower than the conventional threshold, is still considered acceptable for scales with only a few items in early-stage validation. However, the Contemplation subscale, which consists of only two items, yielded a lower alpha value of .417. This finding aligns with prior research noting that two-item subscales often result in diminished alpha values due to limited item covariance, despite theoretical coherence (Ziegler et al., 2014).

Discussion

The findings of this study provide important insights into the adaptation of the Climate Change Stages of Change Questionnaire (CCSOCQ) for use with Turkish middle school students and contribute to a broader understanding of the psychological and educational dimensions of climate change behavior. The confirmed five-factor structure of the scale, as supported by confirmatory factor analysis (CFA), demonstrates that the adapted version maintains the theoretical integrity of the original instrument (Inman et al., 2022). The CFA results, with acceptable model fit indices (see Table 2), indicate that the scale's structure is applicable within the Turkish cultural and educational context (Byrne, 2016; Kline, 2015; İlhan & Çetin, 2014).

The methodological choice to conduct only CFA without EFA is supported by literature recommending CFA for theory-driven scale adaptations, particularly when the instrument has already been validated in its original context (Brown, 2015; Byrne, 2016). In the adapted version of the scale, the original structure consisting of 15 items across five latent factors was preserved. The scale employs a five-point Likert-type response format, consistent with the original instrument. The KMO measure and Bartlett's Test of Sphericity was found to be suitable for factor analysis (Field, 2018) and reinforcing the appropriateness of the sample for structural model testing. Furthermore, Cronbach's alpha, was .738, indicating an acceptable level of reliability for use in the Turkish educational context.

From a theoretical standpoint, the CCSOCQ is valuable in understanding how individuals transition through stages of behavioral change in relation to climate action. As Glenn (2004) and Duckworth & Gross (2020) noted, while social problems such as climate change are driven by collective behavior patterns, changing individual behavior is key to promoting systemic transformation. However, behavioral change does not occur merely through awareness; barriers such as social norms, habits, and perceived inaction of others may inhibit pro-environmental behavior (Van Valkengoed et al., 2024; Hoffman et al., 2024).

In Portugal, the original context of CCSOCQ, climate change education is addressed in an integrated manner as part of citizenship education alongside science (Direção-Geral da Educação [DGE], 2017). According to this approach, it is aimed to gradually increase Portuguese students' awareness of climate change, to enable them to critically approach the problems as a result of this awareness, and ultimately to realize their participation in social action (Pinheiro et al., 2024). In Türkiye, the context of the current study, climate change education is integrated into the content of science courses, and in addition, environmental education is conducted separately as a course that students can choose (Ministry of National Education [MoNE], 2022). However, the revised curriculum, which takes a more holistic view of global issues such as the climate crisis, aims for Turkish students to move beyond

awareness of problems through education to taking responsibility and turning their awareness into action (MoNE, 2024).

The fact that the CCSOCQ yields similar results in the context of Turkish culture may be an indication that despite some differences in practice, the Turkish and Portuguese education systems pursue similar goals in their educational policies to deal with global issues. According to Nogueira (2021), climate action and quality education are interrelated and this requires the transformation of educational policies to ensure environmentally sustainable behaviors (pp. 1-33). Education is known to help society become more resilient to climate crises by increasing the human development index (HDI), especially in developing countries (O'Neill et al., 2020).

This study aligns with findings that increased climate change awareness especially among youth can promote sustainable behavior, though not without emotional and cognitive challenges (Spence et al., 2012; Clayton & Karazsia, 2020; Gianfredi et al., 2024). The Turkish context echoes these findings, as previous studies (Tümert et al., 2024; Gündoğdu et al., 2025) reported that awareness and concern about climate change are positively associated with environmental hope and action orientation among adolescents. Furthermore, the role of education as a transformative force is underlined throughout the literature. Effective climate change education must go beyond transmitting knowledge to fostering critical thinking, emotional engagement, and action-oriented perspectives (Ghosh et al., 2016; Clark, 2024; Trott & Weinberg, 2020). Science education is essential for assisting students in understanding the social as well as scientific aspects of climate change (Kang & Tolppanen, 2024). The CCSOCQ, adapted for Turkish middle school students, offers science educators a robust tool to assess students' readiness to engage in climate action and supports the design of pedagogical interventions tailored to different stages of behavioral change.

Taken together, the findings of this study demonstrate that the adapted CCSOCQ is a valid and reliable instrument for measuring Turkish middle school students' stages of change regarding climate-related behaviors. More broadly, the results underscore the necessity of integrative educational strategies that link awareness with behavioral outcomes. Future research might explore longitudinal applications of the CCSOCQ to monitor developmental trajectories in students' climate action behaviors, or examine how educational programs aligned with students' stages of change can effectively promote lasting pro-environmental practices.

Conclusion

To effectively promote active engagement in climate action, it is crucial to understand the current stance of young people on this issue. Behavioral changes among children and adolescents have the potential to influence parents, policymakers, and broader communities, thereby fostering global awareness (Lawson et al., 2018; Spyrou, 2020). Moreover, today's youth are not only experiencing the immediate impacts of climate change but will also play key roles in shaping decisions as its risks escalate in the future (Davies et al., 2016). For this reason, fostering awareness of their pivotal role in addressing climate change and encouraging environmentally responsible behaviors should be a fundamental objective of environmental education. The psychological framework underlying the CCSOCQ—adapted in this study—recognizes that behavior change unfolds gradually over time

rather than occurring instantly. Identifying the specific stage of behavior change in which students are situated is an essential first step in designing effective educational interventions. In this context, the CCSOCQ offers a valid and reliable means of assessing the behavioral change stages of Turkish middle school students about climate change.

Notes

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References

- Baltikian, M., Kärkkäinen, S., & Kukkonen, J. (2025). Exploring Secondary School Students' Attitudes toward Socio-Scientific Issues with a Focus on Climate Change Attitudes. *International Journal of Education in Mathematics, Science and Technology*, 13(2), 407-438.
- Bray, D., & Nakata, S. (2024). Thinking with children: Climate change and the democratic politics of renewal and risk. *Journal of Applied Youth Studies*, 1-15. <https://doi.org/10.1007/s43151-024-00148-9>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.
- Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3rd ed.). Routledge.
- Brügger, A., Tobias, R., & Monge-Rodríguez, F. S. (2021). Public perceptions of climate change in the Peruvian Andes. *Sustainability*, 13(5), 2677. <https://doi.org/10.3390/su13052677>
- Calculli, C., D'Uggento, A. M., Labarile, A., & Ribecco, N. (2021). Evaluating people's awareness about climate changes and environmental issues: A case study. *Journal of Cleaner Production*, 324, 129244. <https://doi.org/10.1016/j.jclepro.2021.129244>
- Chinowsky, P., Hayles, C., Schweikert, A., Strzepek, N., Strzepek, K., & Schlosser, C. A. (2011). Climate change: comparative impact on developing and developed countries. *The Engineering Project Organization Journal*, 1(1), 67-80.
- Clark, H. F. (2024). Critical climate awareness as a science education outcome. *Science Education*, 108(6), 1670–1697. <https://doi.org/10.1002/sce.21896>
- Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology*, 69, 101434.
- Clayton, S. D., Pihkala, P., Wray, B., & Marks, E. (2023). Psychological and emotional responses to climate change among young people worldwide: Differences associated with gender, age, and country. *Sustainability*, 15(4), 3540.
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

- Cifuentes-Faura, J. (2022). European Union policies and their role in combating climate change over the years. *Air Quality, Atmosphere & Health*, 15(8), 1333-1340. <https://doi.org/10.1007/s11869-022-01156-5>
- Clark, H. F. (2024). Critical climate awareness as a science education outcome. *Science Education*, 108(6), 1670-1697. <https://doi.org/10.1002/sce.21896>
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1), 98.
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3. baskı). Sage.
- Davies, K., Tabucanon, G., & Box, P. (2016). Children, climate change, and the intergenerational right to a viable future. In *Geographies of global issues: Change and threat, geographies of children and young people* (pp. 1-21). Springer, Springer Nature.
- Democracy Now! (2020, January 21). *Greta Thunberg: "Our house is still on fire."* Democracy Now! https://www.democracynow.org/2020/1/21/our_house_is_still_on_fire
- Direção-Geral da Educação. (2017). *Referencial de educação para a cidadania*. Ministério da Educação. https://www.dge.mec.pt/sites/default/files/Curriculo/cidadania_desenvolvimento_orientacoes.pdf
- Duckworth, A. L., & Gross, J. J. (2020). Behavior change. *Organizational behavior and human decision processes*, 161, 39-49. <https://doi.org/10.1016/j.obhdp.2020.09.002>
- Field, A. (2018). *Discovering statistics using IBM SPSS Statistics* (5th ed.). Sage.
- Field, E., Berger, P., Lee, D., Strutt, C., & Nguyen, A. T. (2024). Knowledge, urgency and agency: reflections on climate change education course outcomes. *Environmental Education Research*, 30(11), 2108–2130. <https://doi.org/10.1080/13504622.2023.2296359>
- Filho, W. L., Ayala, D. Y., Wall, T., Shiel, C., Paco, A., Pace, P., ... & Kovaleva, M. (2023). An assessment of attitudes and perceptions of international university students on climate change. *Climate Risk Management*, 39, 100486.
- Gebeyehu, D., Dalelo, A., Eshetu, F., Belachew, W., Wodaj, H., Abate, A., & Hagos, M. (2024). Energy-, Environmental-, and Climate Change Literacy among Primary and Middle School Students. *International Journal of Research in Education and Science*, 10(1), 100-124.
- Ghosh, S., et al. (2016). Teaching climate change: Challenges and perspectives. *International Journal of Science Education*, 38(6), 893–917.
- Gianfredi, V., et al. (2024). Climate anxiety and health: A systematic review. *The Lancet Planetary Health*, 8(1), e12–e22.
- Glenn, S. S. (2004). Individual behavior, culture, and social change. *The Behavior Analyst*, 27, 133-151. <https://doi.org/10.1007/BF03393175>
- Gündoğdu, S. N., Sülü, M., Boz, G., Baran, A., & Özer, A. (2025). İnönü Üniversitesi Tıp Fakültesi öğrencilerinde küresel iklim değişikliği farkındalık düzeyinin incelenmesi. *ESTÜDAM Halk Sağlığı Dergisi*, 10(1), 32-41. <https://doi.org/10.35232/estudamhsd.1539817>
- Hoffmann, R., Kanitsar, G., & Seifert, M. (2024). Behavioral barriers impede pro-environmental decision-making: Experimental evidence from incentivized laboratory and vignette studies. *Ecological Economics*, 225, 108347. <https://doi.org/10.1016/j.ecolecon.2024.108347>
- Hulkkonen, M., Mielonen, T., Leppänen, S., Laakso, A., & Kokkola, H. (2024). How tailored climate information affects attitudes towards climate policy and psychological distance of climate change. *npj Climate*

- Action*, 3(1), 54. <https://doi.org/10.1038/s44168-024-00136-y>
- Inman, C., et al. (2022). Climate Change Stages of Change Questionnaire (CCSOCQ): Development and validation. *Journal of Environmental Psychology*, 82, 101791.
- International Test Commission. (2017). *The ITC Guidelines for Translating and Adapting Tests* (2nd ed.). <https://www.intestcom.org>
- Kang, J., & Tolppanen, S. (2024). Exploring the role of science education as a catalyst for students' willingness to take climate action. *International Journal of Science Education*, 1-19. <https://doi.org/10.1080/09500693.2024.2393461>
- Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). The Guilford Press.
- Lambert, J. L., & Bleicher, R. E. (2017). Argumentation as a Strategy for Increasing Preservice Teachers' Understanding of Climate Change, a Key Global Socioscientific Issue. *International Journal of Education in Mathematics, Science and Technology*, 5(2), 101-112.
- Lawson, D. F., Stevenson, K. T., Peterson, M. N., Carrier, S. J., Strnad, R., & Seekamp, E. (2018). Intergenerational learning: Are children key in spurring climate action?. *Global Environmental Change*, 53, 204-208. <https://doi.org/10.1016/j.gloenvcha.2018.10.002>
- Lin, Z., & Fung, H. H. L. (2024). Age differences in pro-environmental behaviors: Is it about me or the next generation?. *Innovation in Aging*, 8 (Suppl 1), 1372. <https://doi.org/10.1093/geroni/igae098.4373>
- Marpa, E. P. (2020). Navigating Environmental Education Practices to Promote Environmental Awareness and Education. *Online Submission*, 2(1), 45-57.
- Marsh, H. W., Hau, K. T., Balla, J. R., & Grayson, D. (1998). Is more ever too much? The number of indicators per factor in confirmatory factor analysis. *Multivariate Behavioral Research*, 33(2), 181-220.
- McGovern, M., & Cuevas, J. (2025). Environment-based education and environmental literacy: Instructional strategies to improve the employability skills of high school students. *International Journal on Studies in Education*, 7(2), 172-198.
- Ministry of National Education. (2022). *Environmental education and climate change curriculum*. <https://mufredat.meb.gov.tr/Dosyalar/202244102710628-2022-10-cevre-egitimi-iklim-degisikligi-ogretim-programi-web.pdf>
- Ministry of National Education. (2024). *Türkiye Century Maarif Model: Common text*. <https://tymm.meb.gov.tr>
- Nepraš, K., Strejčková, T., & Kroufek, R. (2022). Climate change education in primary and lower secondary education: Systematic review results. *Sustainability*, 14(22), 14913.
- Nogueira, C. (2021). Education in climate change processes. In M. Lackner, B. Sajjadi, & W.-Y. Chen (Eds.), *Handbook of climate change mitigation and adaptation* (pp. 1-33). Springer. https://doi.org/10.1007/978-1-4614-6431-0_156-1
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.
- O'Neill, B. C., Jiang, L., Kc, S., Fuchs, R., Pachauri, S., Laidlaw, E. K., ... & Ren, X. (2020). The effect of education on determinants of climate change risks. *Nature Sustainability*, 3(7), 520-528. <https://doi.org/10.1038/s41893-020-0512-y>
- Pinheiro, S., Torres, A. C., Pereira, B., Malafaia, C., & Menezes, I. (2024). Citizenship education to promote the participation of young people in climate adaptation: crossing curricular boundaries through community profiling. *Curriculum Perspectives*, 1-12. <https://doi.org/10.1007/s41297-024-00231-4>

- Samur, H., & Akman, Ö. (2023). Analysis of Environmental Literacy Levels of Social Studies Pre-Service Teachers. *International Journal on Social and Education Sciences*, 5(3), 605-625.
- Spence, A., et al. (2012). Perceptions of climate change and willingness to act. *Nature Climate Change*, 2, 243–247.
- Situmorang, R. O. P., Hussain, M., & Chang, S. C. (2023). Assessment of environmental orientations of urban Taiwanese and their relation to climate change mitigation behaviour in central Taiwan. *Climate Services*, 30, 100366. <https://doi.org/10.1016/j.cliser.2023.100366>
- Skeiryte, A., Krikstolaitis, R., & Liobikienė, G. (2022). The differences of climate change perception, responsibility and climate-friendly behavior among generations and the main determinants of youth's climate-friendly actions in the EU. *Journal of Environmental Management*, 323, 116277. <https://doi.org/10.1016/j.jenvman.2022.116277>
- Spyrou, S. (2020). Children as future-makers. *Childhood*, 27(1), 3-7. <https://doi.org/10.1177/0907568219884142>
- Stankuniene, D., et al. (2020). Motivating pro-environmental behavior through policy and education. *Sustainability*, 12(12), 5003.
- Sun, Y., & Han, Z. (2018). Climate change risk perception and its influencing factors. *Climatic Change*, 149(3), 253–265.
- Taurinen, A., Kivimäki, M., Niemi, H., & Lehtonen, T. (2024). Climate change education and youth action: Bridging knowledge and participation. *Environmental Education Research*, 30(2), 145–163.
- Tourlioti, P. N., Portman, M. E., Pantelakis, I., & Tzoraki, O. (2024). Awareness and willingness to engage in climate change adaptation and mitigation: Results from a survey of Mediterranean islanders (Lesvos, Greece). *Climate Services*, 33, 100427.
- Trott, C. D., & Weinberg, A. E. (2020). Science education for sustainability: Strengthening children's science engagement through climate change learning and action. *Sustainability*, 12(16), 6400. <https://doi.org/10.3390/su12166400>
- Tümer, A., İpek, M., & Ercan, Z. (2024). Hemşirelik öğrencilerinin iklim değişikliğine ilişkin farkındalık, endişe ve umut düzeyleri: Kesitsel ve ilişkisel araştırma. *Halk Sağlığı Hemşireliği Dergisi*, 6(1), 29-38. <https://doi.org/10.54061/jphn.1396915>
- Van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2023). The psychological distance of climate change is overestimated. *One Earth*, 6(4), 362-391.
- Van Valkengoed, A. M., Perlaviciute, G., & Steg, L. (2024). From believing in climate change to adapting to climate change: The role of risk perception and efficacy beliefs. *Risk Analysis*, 44(3), 553-565. <https://doi.org/10.1111/risa.14193>
- Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, 3(1), 4–70.
- Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist*, 34(6), 806–838.
- Yang, M., Chen, L., Wang, J., Msigwa, G., Osman, A. I., Fawzy, S., ... & Yap, P. S. (2023). Circular economy strategies for combating climate change and other environmental issues. *Environmental Chemistry Letters*, 21(1), 55-80. <https://doi.org/10.1007/s10311-022-01499-6>

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