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RESEARCH ARTICLE

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Exploring the attitudes toward climate change and pro-climate-change behavior among people with sensory disabilities in the Middle East and North Africa

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ABSTRACT

Global ecosystems, including those of the Middle East and North Africa (MENA) region, are severely threatened by the climate crisis. However, there are limited studies on climate change awareness among people with sensory disabilities, especially as climate change affects them as they navigate their daily activities. Guided by Ajzen's theory of planned behavior, 542 participants with sensory impairments in the MENA region completed the Awareness of Climate Change and Pro-Environmental Behavior Willingness Questionnaire. We performed confirmatory factor analysis and multivariate analysis of variance to understand the influence of demographics on awareness and behavior. The instrument demonstrated robust validity and reliability, with appropriate fit indices and mean scores indicating participants' ambivalence toward awareness and pro-climate-change behaviors, as well as notable demographic variations. The findings underscore the need for targeted education and climate change activism, as prescribed by the Sustainable Development Goals (SDGs).

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SUSTAINABLE DEVELOPMENT GOALS
SDG 13: Climate action

Introduction

International mechanisms such as the United Nations Framework Convention on Climate Change (UNFCCC 2015), Goal 13 of the Sustainable Development Goals (SDGs; United Nations 2015), and the Paris Agreement are robust universal interventions born out of the global climate crisis. The UNFCCC (2015) has long recognized education as a pivotal component in responding effectively to climate change, as it fosters an informed citizenry capable of supporting mitigation and adaptation strategies (Ferguson 2019). Similarly, SDG 13 urges countries and individuals alike to take proactive, informed steps to protect the planet and ensure a habitable future for all (Ruppel and Murray 2024; Warren et al. 2022). This SDG encourages multinational cooperation to limit global warming to levels below 2 °C, ideally to 1.5 °C, above pre-industrial levels. The Paris Agreement, also a landmark accord, aimed at limiting global warming to 1.5 °C above pre-industrial levels, promoting equity, and addressing the specific vulnerabilities of marginalized groups, including people with sensory disabilities. The Paris Agreement highlights the responsibility of signatories to enhance human rights, with a focus on empowering disadvantaged communities in climate action (Stein and Stein 2022). Collectively, these and several other international frameworks reinforce the need for inclusive, multi-sectoral approaches that integrate the diverse needs of vulnerable populations and establish ambitious environmental targets (Toussaint and Martínez Blanco 2020).

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There is an intersection between disability and climate injustice. People with sensory disabilities encounter nuanced challenges in the climate change context. In this study, people with sensory disabilities refer to people with hearing and visual impairments. The adverse effects of climate-induced disasters are compounded for such individuals, as they may encounter heightened barriers to accessing early warning systems, healthcare services, and emergency shelters during crises (Fraser 2024; Jodoin et al. 2020). In particular, visual and hearing impairments can significantly hinder the ability to respond to auditory alerts and visual cues that are essential for timely evacuation in emergency scenarios. Moreover, the built environment generally lacks the accommodation necessary for inclusive disaster preparedness and response, leaving people with sensory disabilities more vulnerable to the adverse impacts of climate change (Brown et al. 2025; Kett et al. 2021). These compounded vulnerabilities highlight the necessity for disability-inclusive climate policies that prioritize resilience, accessibility, and equity. However, policymakers have excluded the needs of people with sensory disabilities from contemporary discussions on climate change (Jodoin et al. 2020). This supports tailored approaches to environmental awareness and education, especially in the Middle East and North Africa (MENA) region, which faces some of the harshest weather conditions globally.

Generally, the far-reaching impacts of climate change negatively affect global ecosystems and human communities (Loucks 2021; Scott et al. 2020). The Intergovernmental Panel on Climate Change highlighted that recent warming trends – primarily driven by anthropogenic greenhouse gas (GHG) emissions – have severe consequences, including increased vulnerability to extreme weather events such as intense and more frequent heatwaves and rising sea levels. These consequences threaten global biodiversity, food and water security, and human health, exacerbating socioeconomic disparities and disproportionately affecting low-income and marginalized populations (Dhimal et al. 2021; Ngcamu 2023). Furthermore, climate change crises pose significant public health risks, as evidenced by the high incidence rates of respiratory complications, vector-borne diseases, and heat-related illnesses (Sweileh 2020; Yadav and Upadhyay 2023). Climate-related events further disrupt health systems and increase mental health burdens (Charlson et al. 2021; Cianconi et al. 2020), underscoring the urgent need for resilient public health frameworks that address the full spectrum of climate-related health risks.

The MENA region, comprising 21 Arabic-speaking states, is experiencing rapid anthropogenically driven warming and increased sensitivity to climate change. Over the past four decades, observational data have highlighted a marked temperature escalation, especially in arid and semi-arid zones, with unprecedented temperatures recorded in recent years (Francis and Fonseca 2024). These alterations have resulted in more frequent and intense heatwaves (Zittis et al. 2021), as exemplified by the July 2023 episode, which brought extreme temperatures to countries such as Algeria, Tunisia, and Jordan (Francis and Fonseca 2024). This escalating trend highlights the urgent need to raise awareness of climate change across all societal groups. As one of the world's most water-scarce regions, MENA faces additional strain from climate-induced water shortage. By the late twenty-first century, up to 50% of its population could experience heatwaves exceeding 56 °C (133 °F) for extended periods (Zittis et al. 2021), posing crucial challenges, particularly for marginalized groups lacking access to resources or adaptive capacity.

The MENA region is also prone to climate-induced shifts, such as changes in the Intertropical Convergence Zone, which affect seasonal weather patterns and dust storms. Moreover, the Coupled Model Intercomparison Project Phase 6 is a collaborative framework for climate modeling that projects a comprehensive suite of simulations to explain past, present, and future climate changes, suggesting changes in atmospheric moisture transport in the MENA region (Eyring et al. 2016). This outcome implies that, in the MENA region, climate change will impact water availability, extreme weather events, and regional climate systems, which are critical for planning adaptation strategies, especially for marginalized populations. Therefore, there is a need for specialized climate education initiatives that address the unique needs of individuals with disabilities (Jodoin et al. 2020; Kosanic et al. 2022). Rapid population growth further exacerbates these climate impacts (Maja and Ayano 2021), necessitating infrastructure adaptation and climate-awareness initiatives to safeguard public health and well-being, particularly for marginalized groups (Assaduzzaman 2023; Kolokotsa et al. 2023; Mailloux et al. 2021; Shokry et al. 2022; Wernersson et al. 2024). Despite substantial studies on climate projections in MENA, there is a notable gap in research addressing the impacts of climate change on

awareness and adaptation among marginalized populations, particularly people with sensory disabilities (Francis and Fonseca 2024). Thus, the current study seeks to validate a scale to measure climate-change awareness among people with sensory disabilities in the MENA region.

One of the most widely used theories to study human intention toward a given behavior is Ajzen's theory of planned behavior (TPB; Ajzen 1991). The TPB (Ajzen 1991) was built on the theory of reasoned action, which states that behavior is a product of two related beliefs –normative and behavioral – mediated through intentions. While behavioral belief refers to one's judgment about a given behavior, its relevance, and the perception that they could engage in such behavior, normative belief refers to external pressure whose views or perception could impact one's action. However, Ajzen added that there could be a third behavior – namely, control belief – that could also directly or indirectly predict human behavior. Control belief refers to one's perception that they have been given all the required resources or a conducive environment to engage in a behavior. According to Ajzen, three related beliefs – behavioral, normative, and control – combine to predict human intentions toward a behavior.

In this study, we operationalized the three related beliefs. For instance, behavioral beliefs develop into attitudes toward a given behavior, such as pro-climate-change behavior. Attitude is defined as one's perception toward a given behavior. Thus, an in-depth understanding of a given behavior would enable individuals, such as those living with sensory disabilities, to form appropriate attitudes. Second, normative beliefs accumulate into perceived social norms, which are support or pressure from peers or influential people in an individual's life. Additionally, control beliefs develop into perceived behavior control, which is one's confidence in their ability to engage in a given behavior. Based on the information and resources provided, individuals can decide whether they can engage in a given activity.

The TPB model has been widely supported across disciplines, including teacher education (Opoku et al. 2023; Qin and Tao 2021). To the best of our knowledge, the TPB has yet to be adopted for studies on climate change and people with sensory disabilities. In this study, we applied two components of the TPB model (attitude and behavior). Researchers regard attitude (used interchangeably with awareness in this study) as the first stage toward understanding individuals' behavior. According to the affective, behavioral, and cognitive model of attitude (Cuadrado et al. 2023), cognition, which is one's knowledge of a given behavior, is a measure of attitude. This justification supports our decision to use the notions of awareness and attitude interchangeably in this study. In light of this, we explored the role of attitudes toward climate change in the variance in climate-change behavior. Consequently, we propose the following hypothesis:

> **Hypothesis I:** Attitudes toward climate change will directly predict the willingness of people with sensory impairment to participate in pro-climate-change behavior.

Predictors of climate-change awareness and behavior

There is a scarcity of empirical data on the awareness of and willingness to participate in climate-change behavior among people with sensory disabilities. Existing studies focus on climate-change awareness among students, the general population, and teachers (Dale et al. 2020; Eze 2020; Rahman et al. 2021). Understanding the predictors of climate change awareness and behavior is critical to enabling policymakers to access baseline information that could guide the development of policies that foster environmental engagement and sustainable practices. The current literature consistently identifies sociodemographic factors (Ivković and Mandić 2024; Masud et al. 2017; Patel et al. 2017), psychological drivers (Aral and López-Sintas 2022; Graves and Roelich 2021; Hansmann et al. 2020; Piao and Managi 2024), value orientations (Ni et al. 2024; Song et al. 2022; Yang et al. 2024), and political ideologies (Agissova and Sautkina 2020; Haltinner and Sarathchandra 2022; Smiley et al. 2022) as key determinants shaping climate awareness and pro-environmental behavior. Specifically, sociodemographic factors such as age, education, income, and gender play prominent roles, with younger, educated individuals and higher-income groups generally demonstrating greater knowledge of climate change due to increased exposure to environmental education and resources (Ivković and Mandić 2024; Masud et al. 2017; Patel et al. 2017). Moreover, gender differences are notable, as women often report higher environmental concern and a stronger inclination toward communal well-being, both

of which support pro-environmental behavior (Lehrer et al. 2025). Thus, this study hypothesizes as follows:

> **Hypothesis II:** There will be differences in the demographic characteristics of climate change awareness and behavior among people with sensory disabilities in the MENA region.

Psychological predictors, specifically eco-emotions such as eco-anxiety and eco-anger, also influence climate-change behavior (Stanley et al. 2021). While eco-anxiety can elevate awareness, it may also hinder collective engagement due to emotional exhaustion. By contrast, eco-anger, which reflects frustration over climate inaction, is associated with increased activism and sustained environmental efforts (Bergman 2023; Gregersen et al. 2023). Additionally, individuals with self-transcendent values, emphasizing universalism and community welfare, are more likely to engage in climate-friendly actions than those with self-enhancing, achievement-oriented values (Nartova-Bochaver et al. 2022; Xiang et al. 2019). Political ideology further influences climate awareness (Gregersen et al. 2020), with left-leaning individuals often showing higher engagement due to alignment with pro-environmental policies, where conservative views correlate with climate skepticism, a divide exacerbated by selective media exposure (McCright et al. 2016; Milfont and Osborne 2024). Furthermore, sociocultural and national contexts impact climate awareness (Chan et al. 2019; Hestness et al. 2019). Countries with high carbon footprints and dependence on fossil fuels often exhibit reduced climate concern due to perceived economic risks, whereas societies facing frequent climate impacts show heightened awareness and risk perception (Gaulin and Le Billon 2020; Lazarus and van Asselt 2018). Collectivist cultures, which prioritize community goals, generally show higher environmental consciousness than individualistic societies (Yang et al. 2024), suggesting that effective climate strategies must consider cultural values to encourage widespread pro-environmental behavior (Chwialkowska et al. 2020; Nartova-Bochaver et al. 2022). This body of research underscores the need for targeted approaches that account for these diverse predictors to enhance climate engagement across various demographic and ideological spectra. The perspectives of individuals with sensory disabilities and their willingness to engage in climate-change behavior are yet to be captured in the literature on climate change awareness.

Current study

To the best of our knowledge, no instrument has been used to assess climate-change awareness among people with disabilities. Although several instruments, such as the Knowledge, Attitudes, and Practice (Rahman et al. 2021) and the Climate Stewardship Survey (Walker and McNeal 2013), have been used to study climate-change awareness, we adopted Eze's (2020) Awareness of Climate Change and Pro-Environmental Behavior Willingness Questionnaire (ACCPEBWQ) for this study. The instrument was developed in a context that shares some similarities with the current study environment. This justifies its adoption for the current study. This instrument was designed around two components of the TPB model – attitude and behavior – to explore climate-change awareness among students and teachers. However, the author offered little information on the instrument's validity.

The current study extends previous research on climate change to people with sensory disabilities. The unbearable heat and weather conditions in the MENA region make it an ideal place to develop insights into climate-change behavior (Sever 2021). Despite the negative impact of harsh climate change on people with sensory disabilities (Fraser 2024; Jodoin et al. 2020), no studies have assessed their perspectives on climate change. This study uses two components of Ajzen's TPB (attitude and behavior) to assess the structural validity of an instrument designed to measure climate change awareness and participation in pro-climate-change behavior among people with sensory disabilities in the MENA region. The study was guided by the following research questions: (1) What is the structural validity of the Arabic version of the ACCPEBWQ completed by individuals with sensory disabilities in the MENA region? (2) What are the level and demographic differences between people with sensory disabilities regarding climate change awareness and participation in climate-change behavior in the MENA region?

Methods

Study participants

The study's population included people with sensory disabilities in the MENA region, who share the Arabic language, religion, and practices. The region could be further divided into the Gulf Cooperation Council (GCC) and non-GCC member states (see Figure 1). The GCC member states are among the five major players in the global crude oil trade. There are also several disability activism groups in MENA, such as the Arab Organization of People with Disabilities. People with sensory disabilities are represented in these groups; thus, they were considered for participation in this study. We shared the electronic version of the instrument with association members for distribution on their social media platforms.

The following inclusion criteria were used for data collection: 1) people with disabilities living in the MENA region, 2) people diagnosed with either visual or hearing impairment, 3) adults with a disability in the MENA region, and 4) the ability to consent to participate in this study. Based on previous studies conducted in non-Western contexts on people with disabilities on critical issues such as mental and reproductive health (e.g., Opoku et al. 2024), we anticipated at least 300 participants for this study. Table 1 summarizes the demographics of this study's participants. Overall, 542 people with sensory impairments participated.

Figure 1. Map showing the Gulf Cooperation Council and non-Gulf Cooperation Council member states.
Note: Gulf Cooperation Council member states highlighted
Source: Middle East Briefing (2023)

Table 1. Demographic characteristics of participants.

Category ($N = 542$)	Frequency	Percentage (%)
Disability type		
Hearing impairment	198	37%
Visual impairment	344	63%
Gender ($n = 528$)		
Male	242	46%
Female	286	54%
Country		
GCC	226	42%
Non-GCC	316	58%
Age ($n = 519$)		
18–25 years	131	25%
26–35 years	55	11%
At least 36 years	333	64%
Marital status ($n = 528$)		
Never Married	261	49%
Married	216	41%
Divorced or widowed	51	10%
Number of children ($n = 519$)		
No child	313	60%
1–3 children	141	27%
4 or more children	65	13%
Educational qualification ($n = 521$)		
No formal qualification	130	25%
High school qualification	158	30%
At least bachelor's degree	233	45%
Employment status ($n = 505$)		
Self-employed	97	19%
Public servant	193	38%
Unemployed	215	43%
Training in climate change ($n = 513$)		
Yes	171	33%
No	342	67%

Instrument

We used a two-part instrument for data collection. The first part collected demographic information of the study participants (see Table 1). The second part was the ACCPEBWQ, which was developed for a study in Nigeria (Eze 2020) and adapted for this study. We reworded some items for contextual appropriateness. For instance, in the Nigerian version, the term "generators" (i.e., gasoline-powered electricity generators), which are widely used, was replaced with "solar" (i.e., solar-powered electricity generators), which is also commonly used in the MENA region. The instrument consisted of the following domains: awareness of climate change ($n = 29$) and participation in pro-environmental climate-change behavior ($n = 15$). Awareness of the climate change domain consisted of three subscales (perception [$n = 7$], causes [$n = 11$], and effects of climate change [$n = 11$]). In contrast, pro-climate-change behavior has two subscales (general societal support [$n = 7$] and personal educational initiatives [$n = 9$]). The instrument has a five-point response scale ranging from strongly disagree to strongly agree.

Two of the authors are bilingual and translated the revised instrument into Arabic before implementation. Following this step, six experts with proficiency in Arabic and English and research interests in climate change were asked to review the instrument. Additionally, we invited two academics from disability associations to review the instrument. The disability association recommended not using their countries for data reporting. Instead, they were comfortable classifying countries as GCC or non-GCC members. In the original scale, the author indicated that pro-environmental climate-change behavior is unidimensional; however, two experts recommended dividing it into two subscales. We incorporated the experts' feedback into the revised draft, which was used for data collection. Before using the instrument for data collection in the current study, we piloted it among nonparticipating people with sensory disabilities residing in GCC and non-GCC member countries.

Procedure

The research proposal and instruments used for data collection were approved by the Social Science Ethics Research Committee at United Arab Emirates University (ERSC_2023_3934). Upon receiving

this clearance, we invited executives of the disability associations in the MENA region to participate in this study. We also asked other individuals who worked closely with the various disability organizations to circulate the instrument via digital platforms among the disability association members.

We used Google Forms to collect data between June 2023 and April 2024. The instrument was mainly shared on the social media platforms of disability associations by various eligible members. The instrument was written in Arabic, which is the language spoken in the region. Participants with hearing impairments received the assigned language video explaining the study. Moreover, for those with visual impairment, a voice recording explaining the study was shared alongside the Google Forms link. The instrument contained information about the study's objectives, anonymity of responses, confidentiality, voluntary participation, and withdrawal procedure. Neither country nor personal information was used in reporting the study. The participants were assured that the data would not be made available to parties outside the research team. Participation in the study was voluntary and without remuneration; therefore, respondents were informed that they could withdraw at any time without consequences. All participants provided written informed consent before taking part in this study.

Data analysis

We transferred the Google Forms data to Microsoft Excel for cleaning before importing it into SPSS for analysis. The data were assumed to be normally distributed based on the sample size (Field 2013). For Research Question (RQ) 1, the structural validity of ACCPEBWQ was assessed using confirmatory factor analysis (CFA). The appropriateness of the instrument was determined using the following cutoffs: chi-square ≤ 5, Comparative Fit Index (CFI) and Tucker-Lewis index (TLI) ≥ .90, the root mean square error of approximation (RMSEA) and standard root mean square residual (SRMR) between .03 and .08, and a regression weight of at least .50 (Byrne 2016; Schumacker and Lomax 2016). Validation was performed at both the domain and subscale levels. The relationship between climate-change awareness and pro-environmental climate-change behavior was assessed by examining correlations among the domains and subscales, which were interpreted as small, moderate, or large.

For RQ 2, we calculated mean scores and multivariate analysis of variance (MANOVA; Pallant 2020). The mean score provides information about the participants' level of climate-change awareness and willingness to participate in climate-change behavior. Since the instrument was anchored on a five-point scale, a mean score of at least 4 was interpreted as a positive attitude and willingness to engage in climate-change behavior. Additionally, we calculated MANOVA to examine differences among participants across the combined domains of awareness and behavior. The computation yielded information on combined and individual differences for each subscale. To avoid Type 1 errors, we set the adjusted alpha at .03. In addition, we did not violate the assumption of homogeneity of variances.

Intersectionality and positionality

The current study recognizes and addresses the intersectionality and positionality of the research team members. Positionality refers to a researcher's viewpoint on a given research area or phenomenon (Yip 2024). The research team comprises individuals interested in advancing the well-being of vulnerable groups, such as people with disabilities. Although we do not identify as individuals with disabilities, we have experience advocating for improved services for persons with disabilities. We believe that persons with disabilities are equal members of society and that opening policy spaces would enable them to live independently. Considering this, we perceive ourselves as insiders, as we have a longstanding interest in the development of persons with disabilities.

In terms of intersectionality, Yep and Mutua (2016) argued that multiple social factors influence experiences. Different identities, such as race, gender, and sexuality, come together to shape people's understanding of social identities. First, we comprise people from diverse cultural backgrounds, including Africans, Arabs, Christians, and Muslims. Thus, we brought together different experiences that cumulatively enhanced the study. More so, we believe that sensory disabilities intersect with

other cultural or social realities. Reporting on attitudes toward climate change may end up conflating issues of change. There is also potential for different sensory disabilities to create distinct climate vulnerabilities. This justifies the comparison of perspectives toward climate change based on the demographic characteristics of persons with sensory disabilities.

Results

RQ1: validity of awareness of Climate change and pro-environmental Behavior Willingness Questionnaire

Confirmatory factor analysis for the awareness domain

First, we subjected the 29 items to CFA. The initial calculation yielded poor fit indices: chi-square = 14.61 (CMIN = 5,464.38, df = 374), CFI = .51, TLI = .47, RMSEA = .16, and SRMR = .10. Five items had a regression weight of .50. Following the removal of the five items, although there were some improvements, the fit indices did not reach an acceptable level: chi-square = 13.25 (CMIN = 4,771.20, df = 360), CFI = .62, TLI = .58, RMSEA = .15, and SRMR = .09.

At this stage, the modification, which is the observation of erroneous covariances between the items, was observed. If the erroneous covariances are high, they negatively affect the goodness-of-fit indices. The recommendation is to remove some items or covarying items with high erroneous covariances to improve the fit indices. Iterate deletion resulted in a 10-item distribution into three subscales (perception toward climate change, $n = 3$; causes of climate change, $n = 4$; and effect of climate change, $n = 3$), yielding appropriate fit indices: chi-square = 5.14, CFI = .94, TLI = .91, RMSEA = .08, and SRMR = .04. The regression weight was at least .50 for each of the items (see Figure 2).

Configural invariances were estimated to determine whether the instrument measured the same construct across countries (GCC vs. non-GCC) where the data were collected. For the GCC, the results were as follows: chi-square = 5.03 (CMIN = 452.22, df = 90), CFI = .91, TLI = .88, RMSEA = .06,

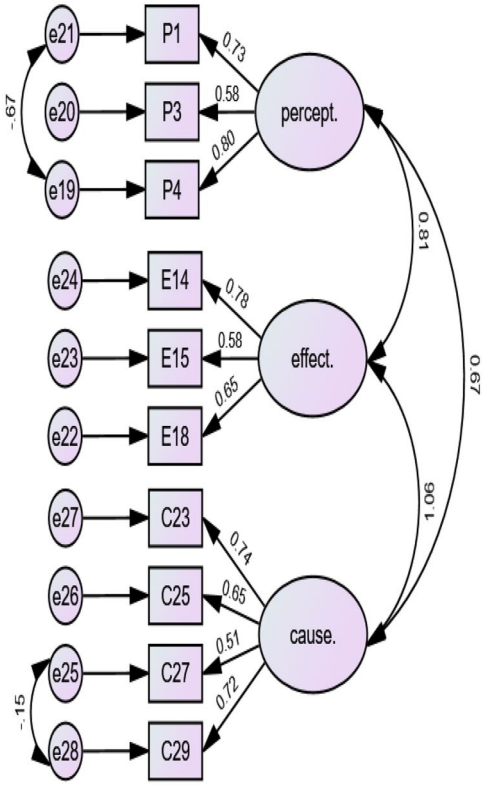

Figure 2. Confirmatory factor analysis for awareness of climate change.
Note: percet. = perception

and SRMR = .04. For non-GCC members, the computations were as follows: chi-square = 5.03 (CMIN = 452.22, df = 90), CFI=.91, TLI = .88, RMSEA = .06, and SRMR = .04. For each computation, the regression weights reached an appropriate level (see Supplementary Material 1 and 2).

Confirmatory Factor analysis for the behavior domain

CFA was computed for the second domain, which is pro-climate-change behavior (see Figure 3). The initial computation yielded a poorly fit model: chi-square = 20.68 (CMIN = 2108.84, df = 102), CFI = .72, TLI = .71, RMSEA = .19, and SRMR = .10. However, the observations of the regression loadings showed that each reached the required threshold. In view of this, we observed erroneous covariances between the items. Iterate deletion of items and covariation of two items improved the model fit indices: chi-square = 11.01 (CMIN = 264.27, df = 24), CFI = .95, TLI = .91, RMSEA = .13, and SRMR = .04. Overall, on this subscale, eight items were supported: educational initiatives ($n = 4$) and general societal support ($n = 4$).

Configural invariance for country type yielded the following results (see Supplementary Material 3 and 4): GCC (chi-square = 7.62 [CMIN = 411.63, df = 54], CFI = .94, TLI = .91, RMSEA = .08, and SRMR = .04) and non-GCC (chi-square = 7.62 [CMIN = 411.63, df = 54], CFI = .94, TLI = .91, RMSEA = .08, and SRMR = .04).

Confirmatory factor analysis for awareness subscales of awareness and behavior

We performed CFA for the combined subscales (see Figure 4). Three items' erroneous covariances correlated with others, and thus, their removal for re-specification, which yielded the following scores:

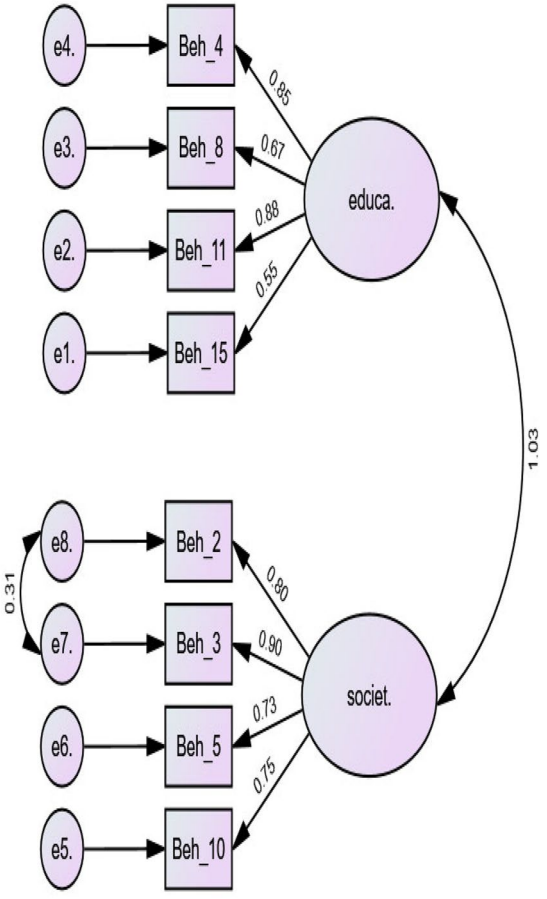

Figure 3. Confirmatory factor analysis for pro-climate-change behavior.
Note: educa. = Educational initiatives; societ. = General societal support

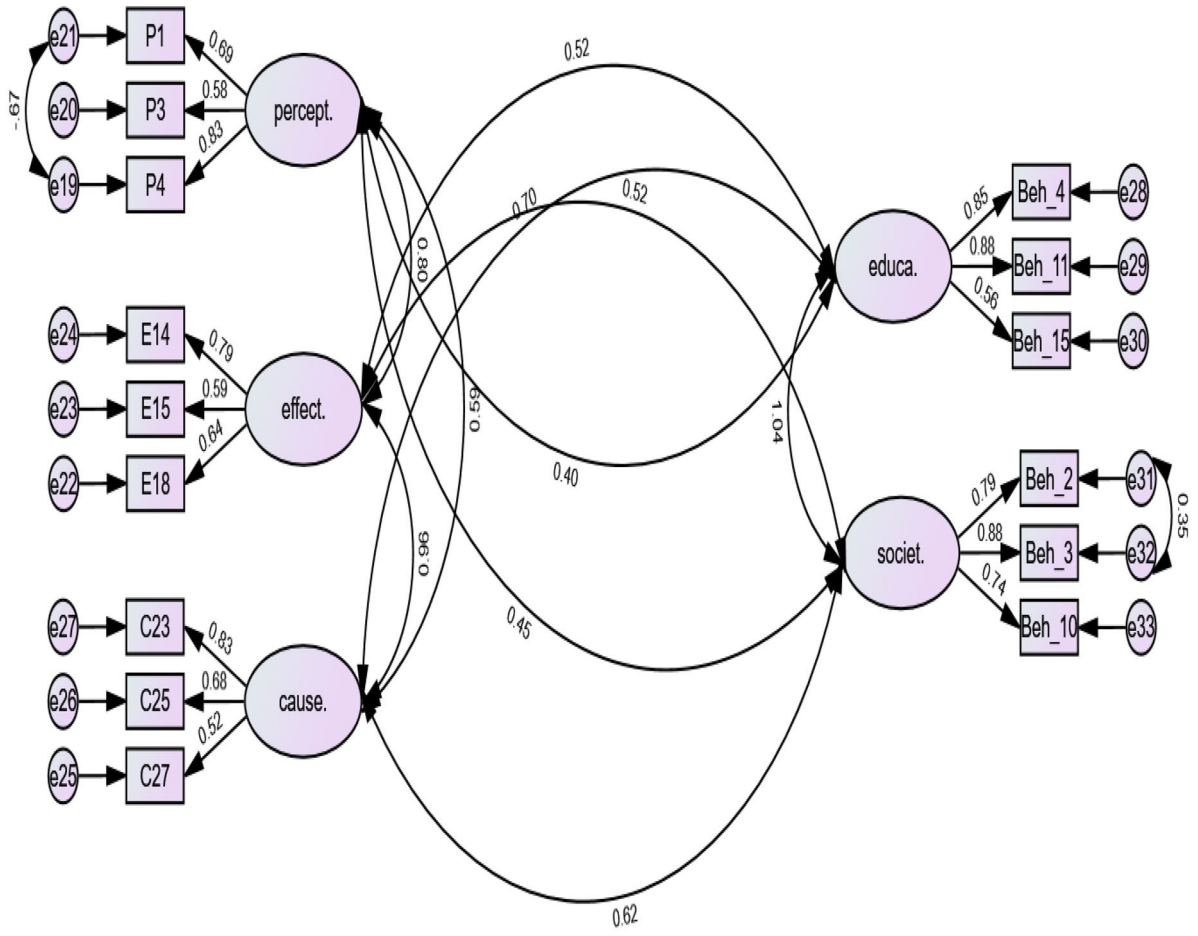

Figure 4. Confirmatory factor analysis for ACCPEBWQ.
Note: percept. = perception; educa. = educational initiatives; societ. = General societal support

chi-square = 6.95 (CMIN = 541.95, df = 78), CFI = .91, TLI = .90, RMSEA = .11, and SRMR = .06. While nine items were supported on the awareness of climate change subscale, six were supported on pro-climate-change behavior.

Configural invariance yielded appropriate scores across the two demographics, see Supplementary Material 5 and 6: GCC (chi-square = 6.08 [CMIN = 1,423.54, df = 234], CFI = .91, TLI = .90, RMSEA = .11, and SRMR = .06) and non-GCC (chi-square = 6.08 [CMIN = 1,423.54, df = 234], CFI = .91, TLI = .90, RMSEA = .11, and SRMR = .06).

Reliability of the awareness of climate change and willingness to support pro-environmental behavior questionnaire

The computation of reliability using Cronbach's alpha yielded the following scores: Overall ACCPEBWQ (.90), awareness of climate change (.85), and participation in pro-climate-change behavior (.91).

RQ2: level of awareness and pro-climate-change behavior

We computed the mean scores at the domain and subscale levels. In relation to the domain, the mean scores were as follows (Table 2): awareness of climate change ($M = 3.50$, SD = .71) and participation in pro-climate-change behavior ($M = 3.79$, SD = .76). For awareness of climate change, the subscales yielded the following mean scores: perception ($M = 3.57$, SD = .78), effect ($M = 3.50$, SD = .82), and causes ($M = 3.42$, SD = .88). With respect to pro-climate-change behavior, the mean scores for the subscales were as follows: general societal support ($M = 3.90$, SD = .79) and educational initiatives ($M = 3.67$, SD = .79).

Table 2. Summary of means on awareness and behavior.

	Items	Means (SD)
	Perception	
P1	Increase in temperature	3.371 (1.16)
P3	Change in weather conditions, such as rainfall and sunshine	3.72 (.85)
P4	Change in the atmosphere due to human pollution	3.61 (1.02)
	Effect	
E14	Rising temperatures and increased heat	3.67 (1.09)
E15	Desertification and reduction of vegetation	3.32 (1.05)
E18	Ill health and strange diseases	3.50 (.96)
	Causes	
C23	Agricultural activities and practices such as bush burning	3.65 (1.05)
C25	Indiscriminate felling of trees	3.22 (1.20)
C27	Increase in population and the need to provide for the exploding populace	3.40 (1.07)
	General societal support	
BEH_2	Doing my bit to reduce the impact of and forestall climate change	3.74 (.94)
BEH_3	Care for the environment by shunning anti-environmental behavior	3.89 (.89)
BEH_10	Planting of trees and replanting of felled trees	4.08 (.84)
	Educational initiatives	
BEH_4	Accepting and adopting all information about mitigating climate change	3.79 (.92)
BEH_11	Rejecting and educating others about agricultural practices, such as bush burning	3.88 (.93)
BEH_15	Advocating for the use of solar	3.36 (1.00)

Difference between participants

We performed a MANOVA to examine differences among participants (Table 3). First, a difference was found between participants in disability type on the combined dependent variables (F[2, 539] = 4.46, Wilks' Lambda = .98, p = .001, with a very small effect size, partial eta squared = .02). Individually, no differences were found between the participants on any of the subscales.

Second, we found a difference among participants in the combined dependent variables by country of residence (F [2, 539] = 11.47, Wilks' Lambda = .96, p = .001, with a moderate effect size). Individually, differences were found between participants' climate-change awareness (F [1, 540] = 10.15, p = .002, with a small effect size, partial eta squared = .02) and their participation in pro-climate-change behavior (F [1, 540] = 22.32, p = .001, with a moderate effect size, partial eta squared = .04). In relation to climate-change awareness, participants in non-GCC countries (M = 3.58, SD = .74) had higher mean scores than those in GCC countries (M = 3.38, SD = .68). Regarding participation in pro-climate-change behavior, those in non-GCC countries (M = 3.92, SD = .62) had higher mean scores than those in GCC countries (M = 3.61, SD = .89).

Regarding age, a difference was found between participants in the combined dependent variables (F[4, 1030] = 7.95, Wilks' Lambda = .94, p = .001, with a small effect size, partial eta squared = .03). Individually, a difference was found between the participants in pro-climate-change behavior only (F[2, 516] = 12.89, p = .001, with a moderate effect size, Partial eta squared = .05). Post hoc comparisons using the Tukey HSD test showed that participants who were at least 36 years old (M = 3.69, SD=.85) were different from the others (18-25 [M = 3.95, SD=.52] and 26-35 years [M = 4.17, SD=.40]) who did not differ from each other.

Additionally, we found a difference between participants' marital status and combined dependent variables, F (4, 1046)=4.87, Wilks' Lambda=.96, p=.001, with a small effect size, partial eta squared=.02. Individually, a difference was found between participants in pro-climate-change behavior, F (2, 525)=8.94, p=.001, with a small effect size, partial eta squared=.03. Post hoc comparison using the Tukey HSD test showed that divorced or widowed people (M = 3.60, SD = .57) were different from single people (M = 3.92, SD = .58). However, neither group differed from those who were married (M = 3.65, SD = .96).

Moreover, we found differences between participants in the number of children on the combined dependent variables (F[4, 1030] = 7.16, Wilks' Lambda = .95, p = .001, with a small effect size, partial

Table 3. Multivariate analysis of variance showing the difference between participants.

			ANOVA F.	
Category	Wilks' Lambda	MAN. F	Awareness	Behavior
Disability type	.98	4.46**	.28	4.75
Partial eta squared		.02	.001	.01
Gender	.99	1.71	3.43	1.05
Partial eta squared		.01	.01	.002
Country	.96	11.47**	10.15**	22.32**
Partial eta squared		.04	.02	.04
Age	.94	7.95**	2.14	12.89**
Partial eta squared		.03	.01	.05
Marital status	.96	4.87**	1.80	8.94**
Partial eta squared		.02	.01	.03
Number of children	.95	7.16**	13.17**	8.79**
Partial eta squared		.03	.05	.03
Educational qualification	.91	13.23**	14.37**	.41
Partial eta squared		.05	.05	.002
Employment status	.98	3.23**	.60	4.90**
Partial eta squared		.01	.002	.02
Training in climate change	1.00	.91	.14	1.63
Partial eta squared		.004	.001	.003

Note.
**$p \leq .01$.

eta squared = .03). Individually, differences were found between participants on climate-change awareness ($F[2, 516] = 13.17$, $p = .001$, with a moderate effect size, partial eta squared = .05) and their participation in climate-change behavior ($F[2, 516] = 8.79$, $p = .001$, with a small effect size, partial eta squared = .03). Regarding climate-change awareness, post hoc comparison showed that those with no children ($M = 3.64$, SD = .67) differed from the other groups: 1–3 children ($M = 3.34$, SD = .65) and at least four children ($M = 3.30$, SD = .82). In addition, on participation in pro-climate-change behavior, once again, those with no children ($M = 3.90$, SD = .63) differed from the other participants, 1–3 children ($M = 3.61$, SD = .92) and at least four children ($M = 3.61$, SD = .96).

Furthermore, we found a difference between participants on educational qualifications on the combined dependent variables ($F[4, 1034] = 13.23$, Wilks' Lambda = .91, $p = .001$, with a moderate effect size, partial eta squared = .05). Individually, a difference was found between participants' awareness of climate change only ($F[2, 518] = 14.37$, $p = .001$, with a moderate effect size, partial eta squared = .05). Post hoc comparisons showed that those without qualifications ($M = 3.24$, SD = .72) were different from the two other groups: high school qualification ($M = 3.60$, SD = .73) and bachelor's degree ($M = 3.62$, SD = .61).

Moreover, we found a difference between participants' employment status and the combined dependent variable ($F[4, 1002] = 3.23$, Wilks' Lambda = .98, $p = .01$, with a small effect size, partial eta squared = .01). Individually, a difference was found between participants in participation in pro-climate-change behavior ($F[2, 502] = 4.90$, $p = .01$, with a small effect size, partial eta squared = .02. Post hoc comparisons showed that those who were public servants ($M = 3.66$, SD = .90) were different from those who were unemployed ($M = 3.88$, SD = .72). However, neither group differed from those who were self-employed ($M = 3.85$, SD = .59).

Discussion

This study aimed to validate an existing instrument and examine associations between the demographic variables of persons with sensory impairments and their climate-change awareness and willingness to engage in climate-change behavior. We focused on persons with sensory impairments in the MENA region, which has one of the harshest climatic conditions globally. The findings of this study should be interpreted in the context of persons with sensory disabilities who have access to digital and social media platforms.

We found the ACCPEBWQ to be a valid instrument for studying climate change awareness and participation behavior among people with sensory impairments. Fifteen items – nine in the awareness domain and six on participation in pro-climate-change behavior – emerged as valid and reliable instruments that could enhance the understanding of climate change among people with sensory

impairments. We performed validation at both the domain and subscale levels, which yielded an acceptable outcome. The instrument's validity was further enhanced by estimating configural invariance, which was used to determine whether the instrument yielded valid indices across a given demographic variable. The study broadly categorized the MENA region into GCC and non-GCC regions, which were used to estimate measurement invariance. The estimation of configural invariance at both the domain and subscale levels supports the instrument's validity. The adapted instrument, ACCPEBWQ, could be used to study climate change awareness among a comparable population in a similar context, thereby deepening understanding of climate change among marginalized societal groups.

The hypothesized relationship between attitudes toward climate change and willingness to participate in climate-change behavior among people with disabilities was supported by the findings of this study. The findings revealed a moderate to strong correlation between awareness subscales and pro-climate-change behavior. Thus, the study confirms Ajzen's (1991) hypothesis that attitude can directly or indirectly contribute to a given behavior. This hypothesis has been confirmed across broad disciplinary areas, such as education (Opoku et al. 2023; Sahli Lozano et al. 2024), and has been further impelled by the study findings. The findings of this study are appropriate because, without changing or improving attitudes, it is difficult for individuals to engage in a given behavior (Ajzen 1991, 2020). Attitude encompasses making information available to people to develop in-depth insights and decide whether they would engage in such an activity. Researchers have consistently reported that education is the first step in improving one's attitude toward engaging in a behavior (Hosseini et al. 2021; Zeidi et al. 2020). In this study, people with sensory disabilities need extensive education to understand climate change before it can contribute to climate change-related activities.

The findings also revealed that the participants with sensory impairments in this study were ambivalent about engaging in climate-change behavior. The mean scores on each subscale were below 4, indicating low levels of positive attitudes and readiness to engage in climate-change behavior. This finding is inconsistent with previous studies reporting positive attitudes and the willingness of students and teachers to participate in climate change activities (Eze 2020; Kolenatý et al. 2022). The findings reported here could be related to the characteristics of the study participants, who were the focus of the current study. Consistent with pertinent issues, such as education, health, and social integration, people with sensory impairments are either excluded from or not considered for participation in the MENA region (Abdullah et al. 2021; Alhammadi 2024). This could be the case in this study, as policymakers seem to have relegated people with sensory impairments to a marginal status regarding discussions on climate change. Disability communities have yet to be included in climate change deliberations. Thus, policymakers in the MENA region need to engage people with sensory impairments related to climate change and encourage their participation in climate change activities. Notably, countries are deadlocked or disagree with climate change policies (Alves et al. 2020; Goniewicz et al. 2025; Santos et al. 2022). There is a window for the disability community to be engaged and included in future climate change discussions.

The demographic variables provided partial support for Hypothesis II. In particular, participants differed by country of origin in their attitudes and climate-change behavior. Compared with their GCC counterparts, non-GCC participants had higher mean scores for awareness and pro-climate-change behavior. Importantly, the mean scores indicated that participants, regardless of GCC or non-GCC region, were generally uncertain about their attitudes and climate-change behaviors. Nevertheless, across both GCC and non-GCC countries, there is a common understanding of disability as a lack of capability, a denial of equal access to services, and a reliance on others (Morgan 2023; Saad et al. 2019; Sargent 2021). In terms of disability advocacy, GCC member countries have created more opportunities for people with disabilities than non-GCC member countries have. It is possible that study participants in the GCC countries are more exposed and could rate their understanding of climate change better than their counterparts in other non-GCC countries. Additionally, the economies of the GCC countries are reliant on crude oil (Vohra 2017); thus, climate change could be perceived as a threat to their national economies. This could have influenced the ratings of the study participants. However, domestically, each GCC is taking steps to embrace climate change and work toward a sustainable future (Alharbi and Csala 2021). In the UAE, the Ministry of Climate Change

spearheads policy development and reforms. Moreover, the country has taken steps to diversify its economy and its dependency on crude oil (Al-Sarihi 2018). Nevertheless, across the GCC and non-GCC countries, there is more room to extend discussions on climate change to the disability community.

We also found that the participants differed in their demographic variables and number of children. The mean scores showed that participants without children had greater awareness and willingness to participate in climate change than those with children did. Previous studies on the effects of childbearing on climate change are mixed (Alipour et al. 2005; Milfont et al. 2020; Prillwitz et al. 2006; Shrum et al. 2023; Thomas et al. 2018). There is evidence that parents raising children have environmental concerns (Alipour et al. 2025; Prillwitz et al. 2006; Thomas et al. 2018). While other studies have reported that having children contributes to improved attitudes and environmental behaviors (Shrum et al. 2023), some authors have reported no relationship between childbearing and climate change (Milfont et al. 2020). Our finding is peculiar, as this is the first study to draw on parents living with sensory disabilities. Indeed, based on the demographic data, 60% of participants had no children, which could have influenced the study's findings. Nevertheless, in the MENA region, the number of children is intricately related to status and recognition in society (Haghighat 2013). Notably, the more children (especially sons) there are, the greater the society's prestige (Haghighat 2013). As a result, this finding was unexpected, as people with sensory impairments who have children usually rely on their children for daily activities and information (Jaiswal et al. 2019, 2020). In this study, it was expected that those with children would rely on them for useful information about climate change. General public awareness of climate change may be low; thus, participants tend to be unable to rely on their children for climate change-related information. However, based on trends identified in previous studies, such a conclusion cannot be drawn, as more studies could be conducted on other populations to compare with the findings reported in this study.

Several limitations make it impossible to generalize the study findings. First, we recruited study participants online, primarily through disability groups in the MENA region. There is a possibility of bias, as the leadership of the disability group could distribute study information with their group of interest. However, we also shared links with other people we knew and encouraged them to circulate the survey within their networks. Nevertheless, the study's findings cannot be generalized beyond our sample. Second, as there was no direct relationship between the study participants and the research team, participants who had questions could not reach us for clarification. However, sufficient and accessible information was provided to prospective respondents before they participated.

Third, the study considered only two of the five components of Ajzen's TPB and did not fully reflect all the tenets of the TPB. Future studies could include additional instruments to provide a fuller understanding of the intentions of people with sensory impairments regarding climate change in MENA and other contexts. Furthermore, the study is a self-report of climate change awareness; thus, it was beyond the scope of the study to substantiate the findings. Nevertheless, the participants completed the instrument in their first language in the MENA region; thus, they provided an accurate account of their experiences. Moreover, we collected data electronically; thus, people without access to social media platforms were excluded from the study. Future studies could use printed questionnaires to include the perspective of people in deprived communities who may not have access to social media. In addition, the study could be extended to other people with disabilities, such as those with cognitive disabilities and their families, as well as to special education teachers, to understand how they teach climate change to students with disabilities.

Conclusion

SDG 13 provides for countries to develop policies to safeguard their environments. This encapsulates public awareness programs that enable the populace to contribute to climate change. While discussions on climate change are ongoing, studies on the extent of climate change awareness among people with sensory disabilities whose lives could be affected by adverse weather conditions are limited. This study aimed to validate an instrument and explore the demographic characteristics of people with sensory impairments that could affect their attitudes and willingness to engage in climate-change behavior. Two components of Ajzen's TPB guided our study to examine the attitudes and willingness of individuals with sensory impairments to engage in climate-change behavior. The results provide

support for the instrument used to measure climate change and support the study's hypotheses. For instance, Hypothesis I was supported, as the study confirmed Ajzen's hypothesized relationship between attitudes and climate-change behavior. Moreover, Hypothesis II was partly supported by demographic variables, such as the number of children and country of origin, which impacted climate change.

The current study is novel, as it extends the discussion on climate change to people with sensory disabilities and highlights the need for policymakers to engage them in these discussions. These findings can inform future climate change policies and reforms. For example, policymakers could develop targeted training programs for people with sensory impairments due to climate change. This could cover issues such as the causes and effects of climate change and empower them to contribute to climate change initiatives. Moreover, policymakers could consider developing accessible climate-change awareness information and communication for people with sensory impairments. They can partner with disability advocacy groups and create accessible information for people with sensory disabilities. An awareness campaign could target families of people with disabilities, as they would share useful information and best climate-change practices with people with disabilities.

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Data availability statement

Data are available upon request from the corresponding author.

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