Acta Psychologica 269 (2026) 107618

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Psychometric testing of the Chinese version of Workplace Age Discrimination Scale and its short-form among Taiwanese teachers

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ARTICLE INFO

Keywords:
Ageism
Age discrimination
Workplace Age Discrimination Scale
Teachers
Psychometric evaluation
Factor structure

ABSTRACT

Workplace age discrimination is a widespread issue that particularly affects older adults. The present study aimed to examine age discrimination within the educational context by validating the Chinese version of the Workplace Age Discrimination Scale (WADS) among Taiwanese teachers. A total of 671 teachers (mean age = 41.0 years; 74% female) completed an online survey. Both full-form (26-item) and short-form (9-item) versions of the WADS were translated using a forward-backward method. All participants were required to complete the Chinese version of WADS and the following external measures: Rosenberg Self-Esteem Scale (RSES), Chinese version of the Depression, Anxiety and Stress Scale-21 (DASS-21) and the World Health Organization Quality of Life Questionnaire Brief version (WHOQOL-BREF). Confirmatory factor analysis (CFA) suggested acceptable model fit for both versions (comparative fit index [CFI] = 0.91 for full-form; 0.98 for short-form). Internal consistency was high (Cronbach's $\alpha \geq 0.93$), and measurement invariance was somewhat supported across sex and educational level. The WADS scores were significantly associated with self-esteem, psychological distress, and quality of life, supporting concurrent validity. Findings suggest that both versions are psychometrically sound instruments for assessing workplace ageism in educational settings. The short-form is particularly suitable for broader applications. Further validation across other occupations and cultures is recommended. The present study provides initial evidence that the Chinese WADS is a reliable and valid instrument for assessing workplace age discrimination among Taiwanese teachers. Its use may help identify age-related barriers in educational settings and support the development of more inclusive workplace policies.

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https://doi.org/10.1016/j.actpsy.2026.107618
Received 5 August 2025; Received in revised form 6 August 2026; Accepted 7 August 2026
Available online 13 August 2026
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1. Introduction

Global population aging has accelerated, with the number of adults aged 65 years and older increasing substantially worldwide (United Nations Department of Economic and Social Affairs, 2020). By 2050, more than 2.1 billion people are expected to be aged 60 years or older (World Health Organization, 2024). This trend is also evident in Taiwan, where adults aged 65 years or above increased from 5% of the population in 2000 to 18% in 2023 (Textor, 2024). As longer working lives become increasingly common, it is important to examine age-related workplace factors, including mental well-being, productivity, and attitudes toward older workers (Christensen et al., 2009; Vatsalya et al., 2017).

Ageism has been identified as a major barrier to healthy and inclusive workplaces, particularly in aging societies (Nelson, 2019). The World Health Organization defines ageism as stereotypes, prejudice, and discrimination directed toward individuals or groups based on age (Officer & de la Fuente-Núñez, 2018). Although this broad definition is valuable, it does not fully capture how ageism is expressed in occupational settings, where discrimination may appear not only as explicit exclusion but also as subtle assumptions about productivity, adaptability, promotion potential, or learning capacity. Such practices may occur at both individual and institutional levels, even when age discrimination is legally prohibited (Bae & Choi, 2023). Given that employed individuals spend much of their lives at work, workplace ageism can have important implications for psychological health, job satisfaction, career development, and continued employment (Harris et al., 2018). Therefore, research in this area requires workplace-specific instruments that can assess both overt and covert forms of age-based discrimination, which provides the rationale for validating the Workplace Age Discrimination Scale (WADS) in the present study.

Although ageism includes three interrelated components, stereotypes, prejudice, and discrimination, age discrimination represents the behavioral expression of ageism and often has the most direct consequences in institutional settings (Officer & de la Fuente-Núñez, 2018). Stereotypes and prejudice refer to cognitive and affective components, respectively, and may function as precursors to discriminatory behavior (Stypinska & Turek, 2017). However, many commonly used measures, such as Kogan's Attitudes Toward Older People Scale and the Aging Semantic Differential, primarily assess general attitudes or stereotypes toward older adults rather than workplace-specific discriminatory experiences (Kogan, 1961; Rosencranz & McNevin, 1969). This limitation is important because age discrimination at work may be reflected in concrete practices, such as differential access to promotion, professional development, leadership opportunities, or evaluations of competence.

Age discrimination remains a prevalent concern in contemporary workplaces. Approximately one-quarter of older Europeans report exposure to age-related discrimination (Bratt et al., 2018), while more than 40% of European workers perceive age discrimination as widespread in the workplace (Perron & McCann, 2018). Similarly, a longitudinal survey in the United States found that 81% of workers aged 50 years and older had experienced age discrimination during the preceding year (Chou & Choi, 2011). In Taiwan, the Employment Management and Workplace Equality Survey conducted by the Ministry of Labour-Republic of China (2024), identified age as one of the most common bases of workplace discrimination. Age discrimination may occur directly, through less favorable treatment based explicitly on age, or indirectly, through ostensibly neutral workplace rules or practices that disproportionately disadvantage age groups without legitimate justification (Duncan, 2003; Furunes & Mykletun, 2010; O'Cinneide, 2005).

Although workplace age discrimination can affect employees across the life course, it is often particularly salient among older workers and those approaching retirement (Ayalon & Bramajo, 2023; Bratt et al., 2018). Teachers represent a particularly relevant occupational group for examining workplace age discrimination because educational institutions place considerable emphasis on seniority, accumulated teaching experience, professional development, and adaptation to changing institutional expectations. Older teachers may be stereotyped as being less adaptable to digital technologies, curriculum reforms, or emerging pedagogical practices, whereas younger teachers may be perceived as lacking authority, experience, and/or classroom-management competence. Such age-based assumptions may influence access to professional training, leadership and promotion opportunities, while negatively impacting collegial relationships, job satisfaction, psychological well-being, and career retention. Given the recognized prevalence of age discrimination in Taiwanese workplaces, validating a workplace-specific measure of age discrimination among Taiwanese teachers is therefore both theoretically and practically important.

Common negative attitudes toward older workers that may cause discriminative behaviors include not having enough capability to perform their tasks well, being less educable, resistance to making changes, being costlier and less beneficial economically, and expecting less return from investment compared to younger people (Bjelland et al., 2010). However, studies have indicated that some negative attitudes (e.g., poor performance and fewer economic benefits for older workers), are not necessarily true, and that performance and proficiency can improve with age (Goldman et al., 2006).

Individuals exposed to age discrimination usually experience less involvement and lower job satisfaction, and their feelings regarding organizational commitment and job sustainability might be distorted (Furunes & Mykletun, 2010; Gee et al., 2007). They may also be at higher risk of work-related stress and strain and may tend to retire early, especially when older than their coworkers (Stypinska & Turek, 2017). Moreover, the association between perceived age discrimination and negative detriments has been identified (e.g., depression, anxiety, reduced interpersonal communication, increased somatic symptoms, work absenteeism, and less adaptability to work-related changes) (Marchiondo et al., 2019; Shippee et al., 2019).

Taiwan has experienced a rapidly increasing aging population over the past few decades, and it is anticipated that a severe workforce shortage may be experienced over the coming decades due to this (Lin & Huang, 2015). Because teaching is one of the occupations in Taiwan with a considerable proportion of mature workers (i.e., aged >50 years; 33.1% among primary schoolteachers; 28.6% among junior high schoolteachers; and 31.1% among senior high schoolteachers); urgent attention is needed regarding ageism and age discrimination in this profession (Chen & Wang, 2012). Teachers have an essential role in the socialization, acculturation, and training of students, and developing any negative attitudes, feelings, and mistreatments, particularly in the workplace among this population, may cause serious problems for the future of any community. Moreover, experienced teachers have more charisma, authority, and confidence than newly qualified teachers, and know how to tailor their knowledge to different pupils, which may impact academic success (Wolff et al., 2017). They also have good relationships with students of all ages and are skillful in facilitating learning experiences in the classroom (Melnick & Meister, 2008). Therefore, to improve working conditions for older teachers, irrespective of age discrimination, special interventions and measures are needed to tackle this phenomenon in schools and educational settings.

The first step in fighting against age discrimination, particularly in the workplace, is to identify how prevalent the phenomenon is (Stypinska & Turek, 2017). For this, having valid and reliable instruments to assess age discrimination is crucial. The Old People Questionnaire, developed by Tuckman and Lorge in 1952, was one of the first measures to assess age discrimination (Tuckman & Lorge, 1952). To date, several instruments have been developed for this purpose (Ludwig et al., 2025). However, these instruments have a notable divergence in content and were essentially designed to assess age discrimination among individuals with different demographics. A systematic review by Peng et al. (2022) showed a lack of consensus in the operational definition and examination of workplace age discrimination (Peng et al., 2022). Moreover, most of these instruments have been developed in

Western cultures, where other kinds of discriminative behaviors, such as sex/race discrimination, may concurrently impact age discrimination. Therefore, further validation of such instruments in different cultures and communities is needed.

The WADS was developed by Marchiondo et al. (2016), in both a full-form (26 items) and a short-form (9 items) to assess perceived age discrimination specifically within workplace contexts. Unlike broader measures of ageism or general discrimination, the WADS captures both overt and subtle/covert forms of age-based mistreatment and is designed to be applicable across different age groups rather than focusing only on older workers. This makes it particularly suitable for the present study, which examines workplace age discrimination among Taiwanese teachers across diverse demographic and educational backgrounds. The original scale demonstrated high reliability, good convergent, divergent, and criterion-related validity, as well as a unidimensional factor structure, particularly among groups at higher risk for age discrimination, such as younger and older workers (Marchiondo et al., 2016). Because the WADS was developed to assess workplace-specific, multidirectional, and both overt and covert experiences of age discrimination, it offers a more contextually appropriate measure for evaluating age-related bias in occupational settings than general ageism scales.

Subsequent validation studies have supported the cross-cultural applicability of the WADS. In the Turkish translation, Özmete et al. (2021) found that the short-form version showed sound psychometric properties among working adults aged 18 years and older. More recently, Funk and Lorenz (2024) reported promising reliability and validity for the German short-form version, while also noting the need for further research on whether the scale adequately captures age discrimination across different ages and genders. Although the original development study supported configural and metric invariance across age groups, evidence from Asian populations remains limited. Therefore, the present study translated and validated the Chinese versions of the WADS, including both the full and short forms, among Taiwanese teachers. More specifically, the present study examined the scale's reliability, dimensionality, concurrent validity, and measurement invariance across sex and educational level.

2. Methods

2.1. Participants and procedure

The present study received ethical approval from the corresponding author's university Human Research Ethics Committee (HREC) (Approval No. 112-686, 31st January 2024). The participants in the study were actively employed teachers, including regular teachers and substitute teachers, in senior high schools, vocational high schools, junior high schools, and elementary schools nationwide. The inclusion criteria included (i) being aged 18 years or older, and (ii) providing informed consent to participate in the online survey study. Those on leave (e.g., parental or caregiver leave) were excluded.

Eligible participants were recruited via email invitations (i.e., the third author of the present study is a schoolteacher who obtained permission from known schools to send email invitations to their teachers) or via subgroups from each local teacher. The links were sent through the local teacher association or subgroups, to northern, central, southern, and eastern areas, reflecting regional diversity. In emails and on social media, a link to the survey (hosted on *SurveyMonkey*) was sent or posted to those interested in participating in the study. Before beginning the survey, potential participants were provided a brief overview of the study's purpose, procedures, and confidentiality measures, and they provided informed consent before proceeding. All participants reported that they had no history of psychiatric, neurological, or substance-related disorders. The survey was anonymous and required approximately 25–35 min to complete. Moreover, the survey platform (i.e., *SurveyMonkey*) checked the IP to avoid duplicate responses. All participants were compensated with NTD 200 (New Taiwan Dollar; 30 NTD $\approx$ 1 USD) for completing the survey.

2.2. Primary measures

2.2.1. WADS (full-form version)

The 26-item WADS was developed by Marchiondo et al. (2016), and assesses discriminatory experiences from populations in a working environment. Marchiondo et al. (2016) first generated 55 items in the phase of deductive item generation. Then, the 55 items were reduced to 26 items (i.e., 26-item WADS or full-form of WADS) in the phase of inductive item generation and initial items. The 26 items were evaluated in a phase of exploratory factor analysis and further item reduction. During this phase, the 26 items were embedded in two factors: Factor 1 contained Items 1 to 19, and Factor 2 contains Items 19 to 26. Item 19 is cross-loaded for both Factors 1 and 2 suggested by the developers (Marchiondo et al., 2016). Although the 26-item WADS showed excellent internal consistency ($\alpha = 0.97$) and strong factor loadings (range between 0.408 and 0.922), 17 items were removed 17 items during this phase because they showed low means and/or low variances. All the WADS items (e.g., *"I have been passed over for a work role/task due to my age"*) are rated using a five-point Likert scale from 1 (*never*) to 5 (*always*), with a higher score indicating greater age discrimination. In the present study, the 26 WADS item scores were summed.

2.2.2. WADS (short-form version)

The nine-item WADS short-form was reduced from the 26-item WADS (Marchiondo et al., 2016). The WADS short-form was evaluated for its one-factor structure using confirmatory factor analysis (CFA) across workers from three age groups: older workers (aged 50 years or older), younger workers (aged 18–30 years), and middle-aged workers (aged 31–49 years). The one-factor structure of the WADS short-form was somewhat confirmed with its measurement invariance being somewhat supported across the three age groups (Marchiondo et al., 2016). Moreover, the internal consistency of the WADS short-form was excellent ($\alpha = 0.93$). The WADS short-form item scores were summed in the present study, and a higher score indicates greater levels of age discrimination.

2.3. Translation procedure for the 26-item WADS and its short-form

Adapted from the translation guideline proposed by Beaton et al. (2000), two bilingual speakers, one working as an English teacher in a senior high school with English qualifications, and the other holding an MSc degree in special education, translated the original English version of the WADS into the traditional Chinese character version as the forward translation. Then, a panel of clinical mental health and education experts, including the corresponding author, who holds an MPhil and Ph.D. in clinical psychology, and a colleague who holds a DPhil in clinical psychology, analyzed the translation and removed culturally incongruent expressions from the instrument to produce a Chinese version of the WADS for back translation. Then, another two bilingual translators, one a Hong Kong speech therapist and a teacher with a BSc degree in English, with over ten years of teaching experience, back-translated the Chinese version of WADS into English for the panel to further evaluate. The panel then used all the translated materials with the original WADS to finalize the Chinese version of WADS for psychometric testing.

2.4. External measures for concurrent validity

2.4.1. Rosenberg Self-Esteem Scale (RSES)

The RSES (Rosenberg, 1965) is a unidimensional measure used to assess global self-esteem. It comprises 10 items rated on a four-point Likert scale from 1 (*strongly disagree*) to 4 (*strongly agree*) to capture positive and negative self-appraisals. Five items are positively worded (e.g., "*On the whole, I am satisfied with myself*"), and five are negatively

worded (e.g., "*I feel I do not have much to be proud of*"). The present study summed the RSES item score after reverse coding the negatively worded items and a higher RSES score indicates greater self-esteem. The Chinese RSES has strong internal consistency and good construct validity among Taiwanese samples, including the general population (Chien, 2002), college students (Wu et al., 2013), and community-dwelling adults (Yeh, 2011). The RSES was chosen as an external criterion measure because experiencing age discrimination is associated with low self-esteem (Balch Samora et al., 2020). The Cronbach's α of RSES in the present study was 0.890.

2.4.2. Depression, Anxiety, Stress Scale-21 (DASS-21)

The DASS-21 (Lovibond, 1995) was used to assess psychological distress. The scale consists of 21 items comprising three subscales: depression (seven items; example: "*It was hard for me to have the initiative to do things*"), anxiety (seven items; example: "*My mouth felt dry*"), and stress (seven items; example: "*I found it difficult to calm myself*"). Participants rate each item on a four-point Likert scale from 0 (*strongly disagree*) to 3 (*strongly agree*). The present study summed the subscale item scores to obtain three separate scores, with higher scores indicating greater psychological distress. The Chinese DASS-21 has satisfactory internal consistency among Taiwanese populations (Oei et al., 2013). The DASS-21 was chosen as an external criterion measure because experiencing age discrimination may lead to psychological distress (Han et al., 2022).

2.4.3. World Health Organization Quality of Life Questionnaire Brief version (WHOQOL-BREF)

The WHOQOL-BREF (WHOQOL Group, 1998) was used to assess four key quality of life (QoL) domains: physical health (seven items; example: "*How satisfied are you with your capacity for work?*"), psychological health (six items; example: "*How much do you enjoy life?*"), social relationships (four items; example: "*How satisfied are you with your personal relationships?*"), and environment (nine items; example: "*How safe do you feel in your daily life?*"). The WHOQOL-BREF items are rated on a five-point Likert scale with different sets of descriptions (e.g., "*very dissatisfied*," "*dissatisfied*," "*neither satisfied nor dissatisfied*," "*satisfied*," and "*very satisfied*"). Domain scores of the WHOQOL-BREF are calculated using a linear transformation on a 4–20 scale, where a higher score indicates a higher level of QoL. The Taiwan version of the WHOQOL-BREF has good construct validity (Yao et al., 2002). The WHOQOL-BREF was chosen as an external criterion measure because experiencing age discrimination is associated with poorer QoL (Chen et al., 2026). The Cronbach's α of WHOQOL-BREF in the present study was 0.929.

2.5. Data analysis

The participants' characteristics were first analyzed using frequencies and percentages. Moreover, the scores of all measures and 26 WADS items were analyzed using means and standard deviations (SDs). The skewness and kurtosis of the 26 WADS items were calculated, and an absolute skewness <3 with an absolute kurtosis <8 indicates normal or close-to-normal distribution (Kline, 2011).

CFA using a maximum likelihood (ML) estimator was used to examine the factor structure of the 26-item WADS and the WADS short-form. The ML estimator was used because all 26 WADS items were normally or close to normally distributed (all absolute skewness <3; all absolute kurtosis <8), and satisfied the assumption of using the ML estimator in CFA. Moreover, the present study had a sufficient sample size for CFA, using the rule of thumb of 20:1 respondent to item ratio (i.e., 26 items require $26 \times 20 = 520$ participants). In addition, missing data were handled using the listwise method. Based on findings from Marchiondo et al. (2016), the 26-item WADS was hypothesized as a two-factor structure (Items 1 to 19 as Factor 1 and Items 19 to 26 as Factor 2); and the WADS short-form as a one-factor structure. Several fit indices (including comparative fit index [CFI], Tucker-Lewis index [TLI], root mean square error of approximation [RMSEA], and standardized root mean square residual [SRMR]) were applied to examine data-model fit. The following cutoffs were used to indicate a satisfactory fit: CFI and TLI > 0.9, together with RMSEA and SRMR < 0.08 (Hoyle, 1995). Via the CFA, factor loadings of every WADS item were retrieved for WADS Factor 1, WADS Factor 2, or the WADS short-form (a loading >0.32 is satisfactory) (Tabachnick et al., 2014).

When the factor structures (i.e., two-factor structure for the 26-item WADS and one-factor structure for the WADS short-form) were somewhat confirmed, measurement invariance was evaluated for both scales across sex (males vs. females) and across educational level (undergraduate degree vs. postgraduate degree). Invariance analyses were conducted across sex because different sexes may interpret item content differently, and measurement invariance is needed to ensure equivalent interpretations across sexes. Similarly, individuals with different educational levels may interpret item content differently because their knowledge differs.

In the measurement invariance evaluation, three nested models were constructed: a configural model assuming both subgroups (e.g., male subgroup with female subgroup) share the same factor structure; a metric invariance model constraining equal factor loadings across subgroups; and a scalar invariance model constraining equal factor loadings and equal item intercepts across subgroups (Putnick & Bornstein, 2016). The three nested models were then compared using ΔCFI, ΔRMSEA, and ΔSRMR. When a more constrained model compared with a less constrained model having $\Delta CFI > -0.01$, $\Delta RMSEA < 0.015$, and $\Delta SRMR < 0.03$, measurement invariance is supported across subgroups (Chen, 2007).

Internal consistency was calculated for the 26-item WADS, its two factors, and the WADS short-form using Cronbach's α and McDonald's ω; and an acceptable value for both α and ω is larger than 0.7 (Cheung et al., 2024; Nunnally & Bernstein, 1994). In addition, corrected item-to-total correlations were calculated for all items in the 26-item WADS, its two factors, and the WADS short-form, of which a value greater 0.3 indicates good corrected item-to-total correlation (Cheung et al., 2024). Finally, Pearson correlations demonstrated using a heatmap were calculated to examine the associations of the 26-item WADS, its two factors, and the WADS short-form with concepts assessed using external measures (including self-esteem, stress, anxiety, depression, physical QoL, psychological QoL, social QoL, and environmental QoL). The 26-item WADS, its two factors, and WADS short-form were expected to be positively correlated with stress, anxiety, depression; and negatively correlated with self-esteem and all QoL domains to indicate good concurrent validity. Cohen's recommendation was used to interpret magnitudes of correlations; that is, an r at 0.1 indicates small magnitude; at 0.3 indicates moderate magnitude; and at 0.5 indicates large magnitude (Cohen, 1988). All the data were analyzed using *JASP 0.17.2.1* (JASP Team). Moreover, the CFA was performed using the *lavaan* mimic function in *JASP* with standard instead of robust estimation.

3. Results

Nearly three-quarters of the 671 participants were female ($n = 498$; 74.2%), and slightly more than one-third of all participants had an undergraduate degree ($n = 229$; 34.1%). The age range of the participants was between 23 and 62 years (mean age = 41.05 years SD = 9.94), and nearly two-thirds of participants had 10 or more years of service in teaching (Table 1). The participants were recruited from various regions of Taiwan, including the northern, central, southern, and eastern areas, reflecting regional diversity. This distribution suggests that the sample was not confined to a single locality. Table 1 additionally reports the participants' scores on measures used in the present study, including the 26-item WADS; Factors 1 and 2 of the 26-item WADS; the WADS short-form; the RSES; stress, anxiety, and depression subscales of the DASS-21; physical, psychological, social, and environmental domains of the

Table 1
Participants' characteristics and scores on measures (N = 671).

Characteristics	n (%)
Sex	
Male	173 (25.8)
Female	498 (74.2)
Years of service	
5 years or below	112 (16.7)
Between 5 and 10 years	146 (21.8)
Between 10 and 20 years	207 (30.8)
Between 20 and 30 years	168 (25.0)
30 years or above	38 (5.7)
Educational level	
Undergraduate degree	229 (34.1)
Postgraduate degree	442 (65.9)
Scores on measures	Mean (SD)
26-item WADS	45.81 (16.28)
WADS Factor 1	34.28 (12.85)
WADS Factor 2	13.30 (4.67)
WADS short-form	16.62 (6.59)
Self-esteem from RSES	28.97 (5.46)
Stress from DASS-21	11.47 (4.26)
Anxiety from DASS-21	9.76 (3.42)
Depression from DASS-21	9.36 (3.64)
Physical QoL from WHOQOL-BREF	14.70 (2.24)
Psychological QoL from WHOQOL-BREF	13.66 (2.67)
Social QoL from WHOQOL-BREF	13.82 (2.41)
Environmental QoL from WHOQOL-BREF	14.49 (2.11)

Note. WADS = Workplace Age Discrimination Scale; RSES = Rosenberg Self-Esteem Scale; DASS-21 = Depression Anxiety Stress Scale-21; WHOQOL-BREF = World Health Organization Quality of Life Questionnaire Brief Version; QoL = quality of life.
Cronbach's α = 0.890 (RSES), 0.948 (DASS-21), and 0.929 (WHOQOL-BREF).

WHOQOL-BREF.

The item properties of the 26-item WADS and its short-form are presented in Table 2. In brief, all the item scores were distributed normally or close to normally (skewness range between 0.8 and 2.1; kurtosis range between −0.01 and 6.46). The skewness and kurtosis values supported the assumption of using the ML estimator in the CFA conducted in the present study. Also, all items had good factor loadings in Factors 1 and 2 of the 26-item WADS; and the WADS short-form, except for Item 19 loading on Factor 2 of the 26-item WADS (loading = −0.06). Although Item 19 has some problems, the present study retained this item for subsequent analyses because the present findings are preliminary in nature for Taiwanese data. Future studies on Taiwanese populations are needed to confirm if Item 19 is really a problematic item. Regarding corrected item-to-total correlation, all items (irrespective of Factors 1 and 2 of the 26-item WADS or the WADS short-form) had relatively good correlations above 0.3 (Table 2).

Fit indices of the 26-item WADS tested on a two-factor structure were relatively good (CFI = 0.91, TLI = 0.90, RMSEA = 0.079, and SRMR = 0.045), and those of the WADS short-form tested on a one-factor structure were better (CFI = 0.98, TLI = 0.97, RMSEA = 0.070, and SRMR = 0.024; Fig. 1). Although the two-factor structure of the entire WADS and the one-factor structure of the short-form WADS both had acceptable fit, the two-factor structure of the entire WADS had fit indices merely acceptable. Therefore, the two-factor structure of the entire WADS needs to be interpreted with cautioun, and more psychometric evidence is needed in future studies.

Nevertheless, based on the somewhat supported factor structures, both the 26-item WADS and its short-form were tested for their measurement invariance across sex (males vs. females) and educational level (undergraduate degree vs. postgraduate degree). All the fit indices (i.e., ΔCFI, ΔRMSEA, and ΔSRMR) indicated measurement invariance for both the 26-item WADS and its short-form (Table 3). However, the configural model of the 26-item WADS had slightly poor fit indices in CFI (0.886) and RMSEA (0.088); and the fit statistics of the 26-item

Table 2
Item properties of the 26-item Workplace Age Discrimination Scale and its short-form.

Item no.	Mean (SD)	Skewness	Kurtosis	Loading[a]	Loading[b]	CITC[a]	CITC[b]
1	1.90 (0.96)	1.06	0.87	0.57	–	0.59	–
2	1.93 (0.89)	0.80	0.41	0.62	0.59	0.63	0.58
3	1.89 (0.91)	0.93	0.56	0.81	0.80	0.80	0.78
4	1.77 (0.93)	1.30	1.47	0.68	–	0.68	–
5	1.83 (0.90)	1.02	0.74	0.81	–	0.80	–
6	1.49 (0.86)	1.93	3.37	0.40	–	0.41	–
7	1.95 (1.01)	0.84	−0.01	0.78	0.80	0.77	0.76
8	1.86 (0.91)	1.00	0.80	0.83	0.85	0.80	0.81
9	1.84 (0.91)	1.07	1.00	0.84	0.82	0.81	0.79
10	1.76 (0.83)	1.08	1.15	0.78	–	0.76	–
11	1.94 (0.97)	1.02	0.80	0.83	–	0.81	–
12	1.83 (0.93)	1.09	0.86	0.86	–	0.83	–
13	1.77 (0.90)	1.06	0.64	0.76	0.77	0.73	0.74
14	1.77 (0.82)	1.08	1.35	0.81	–	0.79	–
15	1.86 (0.88)	0.92	0.68	0.84	0.85	0.81	0.82
16	1.59 (0.75)	1.38	2.37	0.67	–	0.66	–
17	1.84 (0.91)	1.07	0.96	0.86	0.84	0.83	0.81
18	1.70 (0.82)	1.27	1.80	0.83	–	0.80	–
19	1.77 (0.87)	1.10	1.03	0.54/−0.06[c]	–	0.48/0.37	–
20	1.69 (0.83)	1.18	1.28	0.72	–	0.64	–
21	1.65 (0.88)	1.36	1.46	0.41	–	0.43	–
22	1.76 (0.82)	0.97	0.81	0.85	–	0.77	–
23	1.78 (0.84)	0.96	0.71	0.75	–	0.69	–
24	1.68 (0.83)	1.36	2.05	0.84	0.71	0.75	0.67
25	1.40 (0.66)	2.10	6.46	0.58	–	0.59	–
26	1.59 (0.81)	1.50	2.29	0.79	–	0.71	–

Note. CITC = corrected item-to-total correlation. **Bolded** items are included in the short-form Workplace Age Discrimination Scale. Items 1 to 19 belong to Factor 1; Items 19 to 26 belong to Factor 2.
Cronbach's α = 0.96 (factor 1), 0.86 (factor 2), 0.96 (26-item WADS), 0.93 (short-form).
McDonald's ω = 0.96 (factor 1), 0.71 (factor 2), 0.96 (26-item WADS), 0.93 (short-form).
[a] Values for the 26-item Workplace Age Discrimination Scale.
[b] Values for the short-form of Workplace Age Discrimination Scale.
[c] Item 19 cross loaded on both Factors 1 (value before slash) and 2 (value after slash).

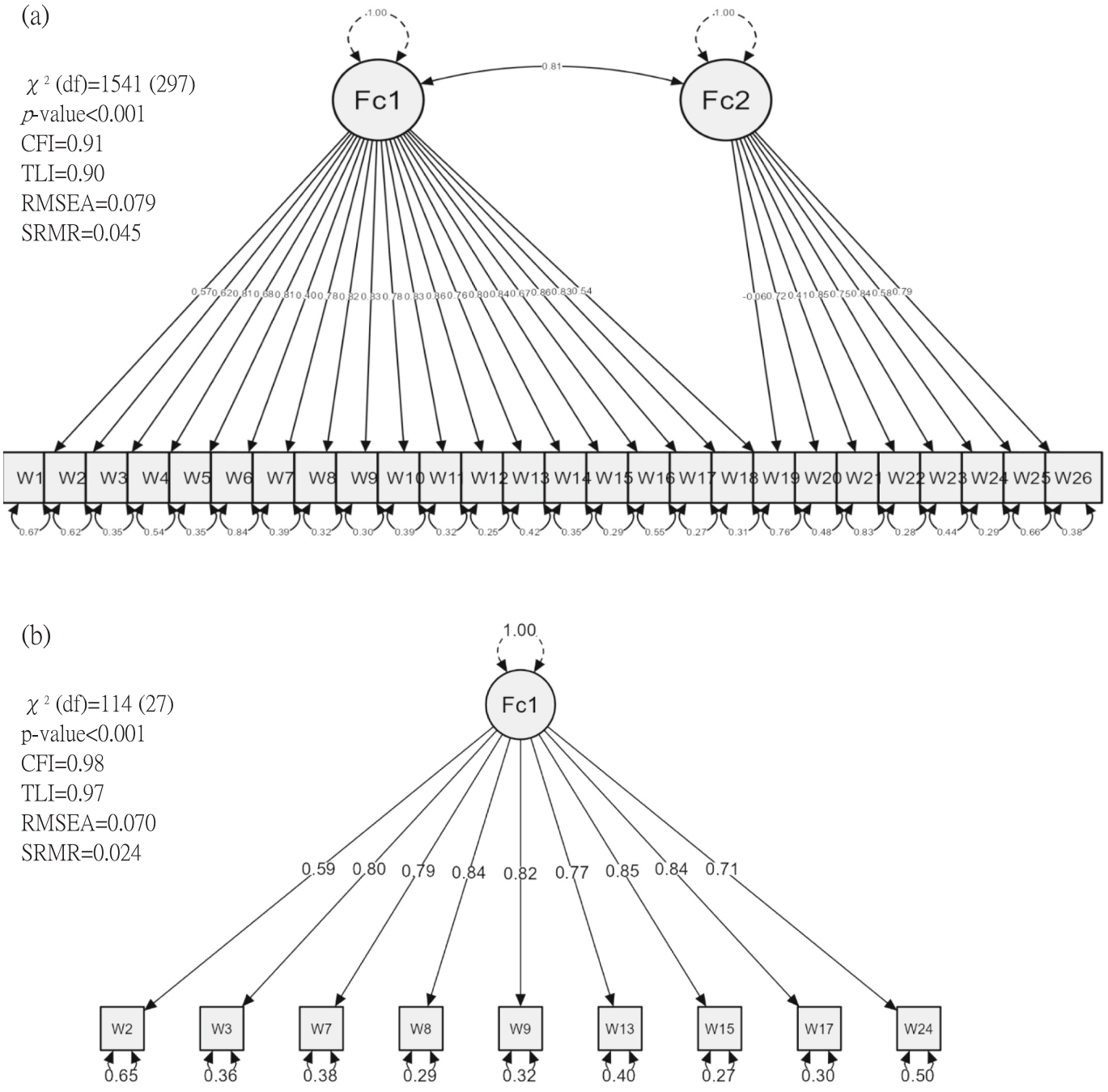


Fig. 1. Factor structure and factor loadings of (a) two-factor 26-item Workplace Age Discrimination Scale and (b) one-factor Workplace Age Discrimination Scale short-form. Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

WADS configural model were somewhat worse than those of the short-form WADS configural model. Moreover, internal consistency was acceptable for the 26-item WADS (α = 0.96; ω = 0.96), WADS Factor 1 (α = 0.96; ω = 0.96), WADS Factor 2 (α = 0.86; ω = 0.71), and WADS short-form (α = 0.93; ω = 0.93).

The heatmap of the correlation matrix (Fig. 2) shows that the 26-item WADS, WADS Factor 1, WADS Factor 2, and WADS short-form had strong correlations ($r = 0.780$ to 0.984; p-values < 0.001). Moreover, the 26-item WADS, WADS Factor 1, WADS Factor 2, and WADS short-form were negatively associated with self-esteem ($r = -0.234$ to -0.202; p-values < 0.001) and all domains of QoL ($r = -0.257$ to -0.346; p-values < 0.001), while positively associated with stress, anxiety, and depression ($r = 0.264$ to 0.347; p-values < 0.001). Moreover, the associations of the 26-item WADS, WADS Factor 1, WADS Factor 2, and WADS short-form with external criterion measures (i.e., self-esteem, QoL, and psychological distress) were in small to moderate magnitudes. In this regard, concurrent validity of the 26-item WADS and its short-form were somewhat supported.

Table 3
Measurement invariance of the 26-item Workplace Age Discrimination Scale and its short-form across sex and across educational level.

Sex	26-item					Short				
	M0	M1	M2	M0 vs. M1	M1 vs. M2	M0	M1	M2	M0 vs. M1	M1 vs. M2
χ^2 (df) or $\Delta\chi^2$ (Δdf)	2126.34 (594)	2191.73 (619)	2263.07 (643)	65.39 (25)	71.34 (24)	164.47 (54)	175.39 (62)	197.89 (70)	10.92 (8)	22.50 (8)
p-Value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.21	0.004
CFI or ΔCFI	0.886	0.883	0.880	−0.003	−0.003	0.974	0.973	0.970	−0.001	−0.003
RMSEA or ΔRMSEA	0.088	0.087	0.087	−0.001	0.000	0.078	0.074	0.074	−0.004	0.000
SRMR or ΔSRMR	0.050	0.063	0.062	0.013	−0.001	0.029	0.039	0.038	0.010	−0.001
Education	M0	M1	M2	M0 vs. M1	M1 vs. M2	M0	M1	M2	M0 vs. M1	M1 vs. M2
χ^2 (df) or $\Delta\chi^2$ (Δdf)	2045.39 (594)	2090.72 (619)	2140.17 (643)	45.33 (25)	49.45 (24)	161.38 (54)	182.68 (62)	195.57 (70)	21.30 (8)	12.89 (8)
p-Value	<0.001	<0.001	<0.001	0.008	0.002	<0.001	<0.001	<0.001	0.006	0.12
CFI or ΔCFI	0.892	0.890	0.888	−0.002	−0.002	0.974	0.971	0.970	−0.003	−0.001
RMSEA or ΔRMSEA	0.085	0.084	0.083	−0.001	−0.001	0.077	0.076	0.073	−0.001	−0.003
SRMR or ΔSRMR	0.051	0.061	0.060	0.010	−0.001	0.029	0.049	0.047	0.020	−0.002

Note. Sex groups included male and female groups; Educational level groups included undergraduate and postgraduate groups.
CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
M0 = configural model; M1 = metric invariance model, constraining factor loadings equal across groups; M2 = scalar invariance model, constraining factor loadings and item intercepts equal across groups.

4. Discussion

The present study assessed the validity, reliability, and factor structure of the Chinese version of the WADS in both short-form and full-form among Taiwanese teachers. However, the CFA fit indices for the two-factor structure of the full-form WADS were merely acceptable. Therefore, cautious interpretation of the two-factor structure is needed. Moreover, the measurement invariance of the two versions of the WADS across gender and educational level was somewhat supported. Results, in general, were supportive of the two versions of the WADSs being valid and reliable instruments to assess age discrimination in the target population. In addition, the two-factor structure of the 26-item WADS and the unidimensional nature of the WADS short-form were somewhat confirmed. However, as the original study showed, the WADS short-form indicated better-fit indices than the full-form, showing that the short-form might have greater construct validity.

As far as the present authors are aware, the WADS has been validated in three languages: English, Turkish, and German (Funk & Lorenz, 2024; Marchiondo et al., 2016; Özmete et al., 2021). However, in previous WADS validation studies, except for the original study, only the short-form of the scale has been assessed in terms of psychometric properties. Moreover, Item 19 was found to be problematic in its factor loadings found in the present study (i.e., a negative loading on Factor 2), which deviates from the original study (Marchiondo et al., 2016).

The problematic performance of Item 19 ("*Responsibilities have been taken away from me due to my age*") may be attributed to the Taiwanese context in the education system. More specifically, in the Taiwanese education system, teachers are not expected to have different levels of responsibility based on seniority or working experience. Instead, the responsibility is typically based on administrative duties. Moreover, the schools in Taiwan usually assign administrative duties to junior teachers because most senior teachers do not want additional workload duties (i.e., having administrative duties increases teachers' workloads). This may somewhat explain the negative loading in this item. Therefore, the focal point of the following discussion is with respect to this version of the scale (i.e., WADS short-form).

Marchiondo et al. (2016) used a comprehensive approach, including three studies with qualitative and quantitative methods, to develop and validate the WADS. They initially developed the scale based on age discrimination experiences among older people. They then validated the instrument among young workers, and finally, they examined the applicability of the scale for middle-aged employees. Although they found appropriate psychometric properties for the scale, the criterion-related validity of the scale among middle-aged workers compared against older and younger people was not supported. Therefore, the scale seems consistent with the theoretical basis that age discrimination is more notable among younger and older workers. At the same time, it usually decreases among middle-aged workers.

Although in the present study, measurement invariance of the scale was not examined across age, Funk and Lorenz (2024), similar to the development study, found both metric and scalar invariance across ages. Therefore, this indicates the WADS (particularly its short-form) might be a suitable instrument to assess age discrimination among individuals who are in different age ranges.

In the present study, the measurement invariance of the WADS was further assessed across sex and a new demographic variable (i.e., education level). Marchiondo et al. (2016) found that the both full-form and short-form of WADS were invariant across the age groups. In addition, Funk and Lorenz (2024) assessed the measurement invariance for WADS short-form across both age and gender with promising results. Based on those findings, the present study added the educational variable for measurement invariance to assess how the WADS may work for those who had either undergraduate or postgraduate level of education. As aforementioned, both scales indicated acceptable measurement invariance for the sex and educational level, despite a better result for the WADS short-form. Therefore, the scale in both forms may adequately assess the same thing (age discrimination) among males and females and those with higher and lower university degrees. However, careful interpretation of the measurement invariant findings on the full-form WADS is needed because its configural model showed somewhat inferior model fit, especially compared to the short-form WADS.

The present findings therefore somewhat supported the significant associations between the sex/education and discrimination in the workplace found in the previous studies (Hennein et al., 2023; Newman, 2014; Pietiläinen et al., 2020). The measurement invariance findings in the present study indicate that different genders and individuals at different university education levels interpret the WADS items similarly. In this regard, the comparisons of WADS scores between different gender groups and different educational level groups were meaningful and real. However, the present study only recruited teachers to validate the WADS for measurement invariance. Therefore, future studies are needed to explore if such measurement invariance findings also exist

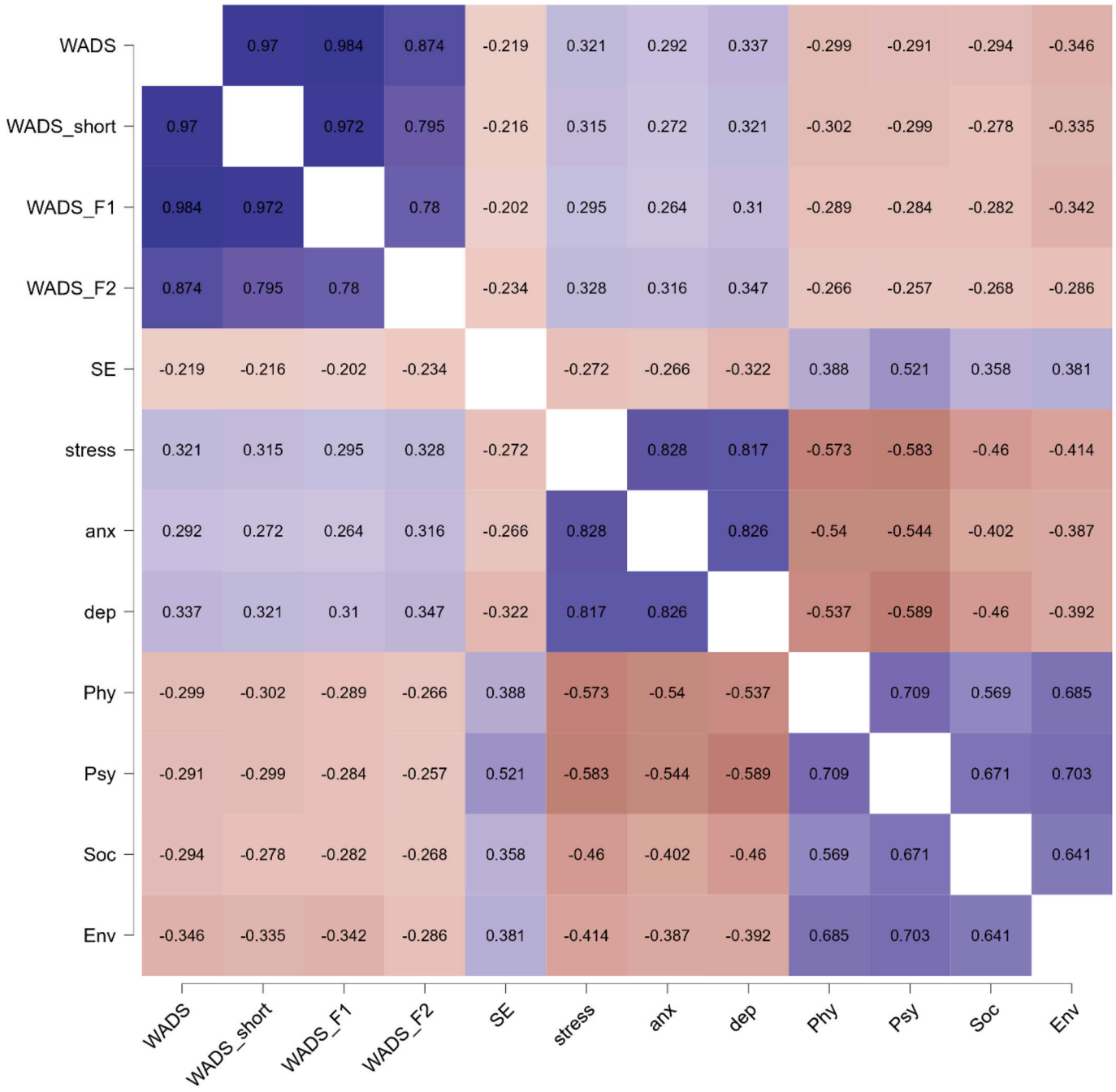


Fig. 2. Heatmap showing concurrent validity of the 26-item Workplace Age Discrimination Scale (WADS) and its short-form with self-esteem, psychological distress, and quality of life. Note. WADS_short = short-form of WADS; WADS_F1 = Factor 1 of WADS; WADS_F2 = Factor 2 of WADS; SE = self-esteem; anx = anxiety; dep = depression, Phy = physical quality of life (QoL); Psy = psychological QoL; Soc = social QoL; Env = environmental QoL. Blue color indicates negative correlation; red color indicates positive correlation; darker color indicates stronger correlation. All p-values < 0.001. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the present paper)

among individuals from other occupations.

Although the factor structures of the scales in the present study were similar to previous studies, as Marchiondo et al. (2016) explained, the two-factor solution that was found in the present study, like the original study, would not be a justifiable reason to consider the full WADS as a scale with two definite and differentiated factors. In other words, consistent with the original study, a considerable part of the variance was explained by the first factor with 18 items, and the second factor only determined a trivial proportion of the variance. In addition, as found in the original study, all items in the present study loaded on the second factor were not related to overt aspects of age discrimination. Therefore, similar to the original study, the concept of age discrimination as an integrated concept theoretically might be divided into two factors statistically.

To assess the concurrent validity of the WADS, various scales different from those used in the previous studies were used. As expected, self-esteem (on the RSES) showed a significantly negative association with both versions of the WADS in small to moderate magnitudes, indicating that those who experience age discrimination appear to have lower self-esteem. The relationship between these two variables has been documented in previous studies (Balch Samora et al., 2020; Furunes & Mykletun, 2010). As Bleidorn et al. (2016) suggested, self-

esteem may decrease as people get older, therefore it is expected older adults will have lower self-esteem than younger adults (Bleidorn et al., 2016). However, experiencing any age discrimination behavior in the workplace may intensify this reduction. Therefore, it may be that those exposed to age discrimination may be at risk of diminished self-esteem, which may affect not only individual productivity and achievement in the workplace but also the personal and family lives of the workers.

The present study also showed that the WADSs demonstrated positive significant associations with stress, anxiety, and depression, as well as negative associations with good QoL in small to moderate magnitudes. These findings also support the concurrent validity of the WADS as many studies have shown, any type of discrimination may lead to psychological distress (Han et al., 2022; Hennein et al., 2023). Therefore, the significant associations between age discrimination and these variables were unsurprising. However, any negative attitudes or mistreatments toward worker's age that occur in a work setting may unpleasantly impact work-related skills, and this eventually may cause further negative emotional feelings toward the co-workers that may result in a vicious cycle threatening job sustainability and sound work relationships and communications.

Therefore, as a byproduct of the present study's findings, any correlations between age discrimination and mental health in work settings should be addressed by future researchers to find solutions against developing mental health problems, especially among teachers as a vulnerable population. Moreover, as other studies have shown, any inconvenience, particularly negative feelings and emotions toward colleagues in a work setting, may also reduce QoL (Bodner & Cohen-Fridel, 2010; Molina-Luque et al., 2022).

Reliability of the WADS, as examined using Cronbach's α and McDonald's ω, were both satisfactory. In the initial development of WADS, Marchiondo et al. (2016) reported a Cronbach's α of 0.91–0.93 for nine-item scale and 0.97 for 26-item scale which are comparable to the present study's findings. Indeed, the full-form WADS with more items, as expected, had higher internal consistency. However, in other studies that assessed only the short-form of WADS, Cronbach's α ranged from 0.90 to 0.94, which is similar to that in the present study (α = 0.93). In addition, Funk and Lorenz (2024) also reported a similar McDonald's ω as that found in the present study (ω = 0.93).

4.1. Strengths and limitations

Although the study benefited from strengths such as having an adequate sample size, using different statistical methods to assess psychometrics of the scales from different aspects, and assessing both full and short-forms of the WADS (whereas other studies only evaluated the short-form of the WADS), some limitations should also be noted. First, a convenience sample of Taiwanese teachers was used. In this regard, the findings may not be generalizable to all teachers that may be at risk of age discrimination. Second, the test-retest reliability of both versions of the WADSs was not examined because the study was cross-sectional. Therefore, whether both versions of the scale have good reproducibility and stability across time is unclear, and longitudinal designs are needed. Third, all instruments used in the study were self-report measures which means that recall/information biases may be present. However, because age discrimination is a subjective concept and there is no available objective way of assessing the concept, there were no other choices for further assessment and reducing these biases. Fourth, the estimation method used in the present study (i.e., ML estimator) is inappropriate for ordinal scales (e.g., the Likert-type scale in the WADS). However, the prior literature testing WADS used ML estimator (e.g., Özmete et al., 2021; Valadas et al., 2025) or did not specify what estimator was used (e.g., Funk & Lorenz, 2024; Marchiondo et al., 2016). Therefore, the present study intended to provide comparable findings to the literature and used ML estimator. Moreover, considering that all 26 WADS items in the present study showed acceptable score distribution (all absolute skewness <3; all absolute kurtosis <8), the use of ML estimator may not have had any severe deviation in the CFA findings. However, future studies are encouraged to use estimation methods developed for ordinal scales (e.g., diagonally weighted least square estimator or weighted least squares means and variance-adjusted estimator) to further examine the factor structure of WADS. Lastly, a reminder is needed regarding the relatively modest fit indices for the full-form WADS and the fit indices of the full-form WADS that they were worse than those of the short-form WADS. Therefore, cautious interpretation of its two-factor structure is needed and further empirical evaluation is required.

5. Conclusion

The present study showed that both full-form and short-form of the WADS are suitable for to assess age discrimination among Taiwanese teachers. However, because the short-form showed better fit indices and needs less time to complete, using the short-form is recommended particularly among workers with lower motivation or time for participation. Moreover, the full-form WADS only had modest fit indices with a problematic item (i.e., Item 19). Therefore, the two-factor structure of the full-form WADS should be interpreted with cautioun. Based on the significant associations between age discrimination and negative health-related outcomes (e.g., stress, anxiety, depression, low self-esteem and low QoL), further assessment of such outcomes particularly among teachers is needed. Moreover, those teachers who likely are exposed to age discrimination such as younger teachers or those who are close to retirement should receive further attention from school authorities and decision-makers to protect against negative psychological-related complications. Further assessment and validation of the WADS in other communities and different occupations with the consideration of cultural contexts would be helpful better to understand the concept of age discrimination and its correlates.

Compliance with ethical statement

The study was approved by the Human Research Ethics Committee (HREC) at the corresponding author's University.

CRediT authorship contribution statement

Mohsen Saffari: Writing – original draft, Investigation, Data curation, Conceptualization. **Chung-Ying Lin:** Writing – original draft, Investigation, Formal analysis, Data curation. **Wei-Ting Lin:** Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **I-Hua Chen:** Writing – review & editing, Methodology, Investigation. **Servet Üztemur:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Mark D. Griffiths:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Yun-Hsuan Chang:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Funding

The study was partly supported by the National Science and Technology Council (NSTC 111-2314-H-006-002-MY3, NSTC 113-2321-B-006-014, NSTC 114-2410-H-006-120, NSTC 115-2410-H-006-061 & NSTC 115-2629-H-006-001-MY2) and Academia Sinica (Grant Number: AS-GCS-113-H01), as well as partly by the Higher Education Sprout Project, Ministry of Education to the Headquarters of University Advancement at National Cheng Kung University (NCKU) (Grant Number: R114-17603, D114-F2587 and D115-F2587) to YHC.

Declaration of competing interest

All the authors declare that there is no conflict of interest.

Acknowledgments

We want to thank the research teams and all the participants who completed the survey.

Data availability

Data are available from the corresponding author upon reasonable request.

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