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Unveiling the Psychometric Properties of the Satisfaction with Life Scale: An Item Response Theory Study in Gay Adults

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Abstract

The Satisfaction with Life Scale (swls) has been validated in heterosexual individuals using Classical Test Theory (CTT). The aim of the present study was to analyze the psychometric properties of the swls using Item Response Theory (IRT) to address gaps in the existing literature. The original structure comprising five items, as well as an abbreviated version with four items, were examined in a sample of 400 cisgender gay people from Lima, Peru. The results confirmed the unidimensionality of the scale in both versions, which demonstrated adequate psychometric properties with slight differences. Both versions can be used interchangeably without affecting the scale's structure. However, if the objective is to assess more accurately across a broader range of abilities, the 5-item version appears to be superior. Practical implications are discussed.

Keywords: Item Response Theory, satisfaction with life, cisgender gay people, sexual orientation, psychometric properties.

Desvelando las Propiedades Psicométricas de la Escala de Satisfacción con la Vida: Un Estudio de Teoría de Respuesta al Ítem en Adultos Homosexuales

Resumen

La Escala de Satisfacción con la Vida (swls) cuenta con múltiples validaciones en personas heterosexuales desde la teoría Clásica de Tests (CTT). El objetivo del presente estudio fue analizar sus propiedades psicométricas a partir de la Teoría de Respuesta al Ítem (TRI). Se examinó la estructura original de cinco ítems y una versión abreviada de cuatro, en una muestra de 400 personas gais cisgénero de Lima (Perú). Los resultados confirmaron la unidimensionalidad de la escala en sus dos versiones, con adecuadas propiedades psicométricas y ligeras diferencias. Ambas versiones pueden ser utilizadas indistintamente sin afectar su estructura, pero si el objetivo es evaluar con mayor precisión en el rango de habilidades, la versión de 5 ítems parece ser superior. Se discute sus implicancias a nivel práctico.

Palabras clave: Teoría de Respuesta al Ítem, satisfacción con la vida, personas homosexuales cisgénero, orientación sexual, propiedades psicométricas.

Introduction

The study of well-being has become a significant focus within psychology, particularly in developed societies where its measurement is of growing concern (Helliwell et al., 2023; Lingán-Huamán et al., 2024). Its relationship with health is indisputable, extending beyond the absence of disease to encompass an enhanced quality of life (Fernández-López et al., 2010; World Health Organization [WHO], 2014).

Psychological research identifies two main approaches to well-being: the hedonistic and eudaimonic. The hedonistic approach focuses on pleasure and the avoidance of pain (Diener et al., 2009; Ryan & Deci, 2001), while the eudaimonic approach emphasizes human potential and self-realization (Ryan & Deci, 2001; Ryff & Singer, 2008). The former frames Subjective Well-Being (SWB) as an individual's assessment of life satisfaction (LS), whereas the latter views Psychological Well-Being (PWB) as a relational construct tied to life's meaning (Keyes et al., 2002; Pavot, 2014; Ryan & Deci, 2001).

This study focuses on LS, a component of SWB that reflects its evaluative-critical aspect without directly addressing the emotional experience of happiness associated with the affective component. LS represents a global assessment of quality of life, based on personal and subjective appraisals that compare one's current state with an ideal life state (Diener et al., 1985, Diener et al., 2018; Shin & Johnson, 1978). The construct can be measured using the Satisfaction with Life Scale (SWLS), developed by Diener et al. (1985). This instrument is widely used and has been adapted in multiple countries (Emerson et al., 2017; Jovanović et al., 2022; Pavot & Diener, 2008; Pavot, 2014). However, when evaluating its psychometric properties, sexual orientation has not been explored. This leaves a gap in knowledge and an opportunity for research in individuals with diverse sexual orientations.

For sexual minorities, LS reflects the attainment of their rights, including access to a strong healthcare system, equal employment

opportunities, participation in political decisions, and, most importantly, the assurance of acceptance and protection from violations (Badgett & Sell, 2018). However, in many countries, heteronormative views on sexuality persist (Ading et al., 2021; Bartram, 2021; Petrou & Lemke, 2018; Zambrano, 2022). Research has shown that discrimination and/or homophobia are linked to increased stress levels (Elmer et al., 2022; Meyer, 2003; Michaels et al., 2019; Pepping et al., 2018), as well as a negative perception of life (Douglas et al., 2020). Such experiences hinder self-acceptance (Batten et al., 2020; Camp, 2020; Peng et al., 2020; Pineda-Roa et al., 2021) and contribute to low levels of LS (Checa et al., 2022; Michaels et al., 2019; Petrou & Lemke, 2018).

The study of life satisfaction (LS) in sexual minorities is an emerging field (Checa et al., 2022; Herran, 2022; Michaels et al., 2019; Petrou & Lemke, 2018); however, there is a lack of adapted or validated instruments to assess it. One review identified a study in Spain that examined the sexual orientation invariance of the SWLS. The study's primary findings included the demonstration of satisfactory psychometric properties and sexual orientation invariance. However, the sample size ($n = 212$ heterosexuals, 182 gays, and 138 bisexuals) and the heterogeneity of the analysis of the results were identified as limitations (Checa et al., 2022). In Peru, the SWLS was employed in a correlational study with LGBT individuals, but no data on its psychometric properties were provided (Herran, 2022).

The SWLS consists of five items with seven response options (Pavot & Diener, 1993). The scale has a unifactorial structure and demonstrates relationships with other constructs linked to well-being, as well as clinical measures of anxiety and depression. It also shows high internal consistency (α between .79 and .89) and temporal stability (test-retest reliability of .83). Notably, the use of short scales like the SWLS offers significant advantages when the goal is to efficiently assess psychological traits in large populations through

large-scale applications (Kjell & Diener, 2021; Sandy, 2017). Some researchers suggest that reducing the number of response options may help to minimize errors in participants' response patterns (Álvarez-Merlano & Castro-Bocanegra, 2022; Atienza et al., 2000; Flaskerud, 2012; Hanzlová, 2022; O'Connor et al., 2015).

In 2021, an abbreviated version of the SWLS was introduced, featuring the first three items of the original scale. Its one-factor structure was validated within a cognitive well-being model (Espejo et al., 2022; Kjell & Diener, 2021). Regarding the original version of the SWLS, numerous studies have confirmed its unidimensionality and psychometric robustness using Classical Test Theory (CTT), which assumes a linear relationship between item characteristics and observed scores (Emerson et al., 2017; Jovanović et al., 2022; Pavot & Diener, 2008). However, there is a notable lack of research utilizing Item Response Theory (IRT) to evaluate the relevance of individual items to the construct (Hanzlová, 2022; Nima et al., 2020; Oishi, 2006; Vittersø et al., 2005). IRT models the relationship between the traits of the individuals being assessed and the properties of the items, optimizing the precision of trait or attribute estimation.

CTT analysis reveals that item 5 of the original SWLS shows reduced factor loadings and weaker convergence with the overall scale (Atienza et al., 2000; Calderón-De la Cruz et al., 2018; Caycho-Rodríguez et al., 2018; Diener et al., 1985; Kjell & Diener, 2021; Jovanović, 2016; Jovanović et al., 2022; Moksnes et al., 2014; Pavot & Diener, 2008). Researchers suggest that these discrepancies may be due to differences in item content and temporal orientation. Items 1 through 4 exhibit heterogeneity, with their wording focused on the present, whereas item 5 may overlap in content with item 4 been both more retrospective and meta-evaluative in nature (Calderón-De la Cruz et al., 2018; Clench-Aas et al., 2011; Moksnes et al., 2014).

The application of IRT in the validation of the SWLS has demonstrated that item 5 presents response difficulty and should be modified or eliminated to enhance the psychometric properties of the instrument (Hanzlová, 2022; Nima et al., 2020; Oishi, 2006; Vittersø et al., 2005). This is supported by the arguments presented by Pavot and Diener (2008) and Kjell and Diener (2021), who posit that the item in question has an evaluative connotation regarding the past. As a result, it may prompt memories at the cognitive level and affect perception at the time of testing, in contrast to the other items. The aforementioned evidence suggests that validating a four-item version may yield more robust measures of SV.

Considering the preceding points, it is anticipated that the discrepancy in the evaluation and validation of instruments designed to assess positive psychological constructs among sexual minority populations will be addressed. The majority of existing studies focus on the adverse consequences associated with non-heterosexual orientations. Consequently, the value of this study lies in its contribution to the field by initiating a line of research aimed at further validating positive instruments in sexual minorities. The objective of the present research is twofold: firstly, to analyze the psychometric evidence pertaining to the original version of the SWLS; and secondly, to compare the results obtained with a four-item version using IRT in cisgender gay people in Lima.

Method

Participants

The sample consisted of 400 self-identified cisgender gay people between the ages of 18 and 70 ($M = 32.4$, $SD = 9.24$). 75.5% were from Lima (Peru), while the remaining 24.5% were from the provinces. In terms of sexual orientation, 97.2% of the participants identified as gay men, while

2.8% identified as lesbian women. In terms of educational attainment, 46.5% of the sample had completed secondary education, 52.5% had obtained a higher education qualification, 0.8% had completed primary education, and 0.2% had no formal education. Regarding employment status, 5.2% were unemployed, 73.8% were dependent workers, and 21% were self-employed. It should be noted that individuals who were in a process of self-acceptance or uncertainty about their identity and/or sexual orientation were not included in the sample.

Measures

The SWLS is a widely applicable instrument for assessing life satisfaction (Diener et al., 1985). It was originally developed in the United States and later adapted into Spanish by Atienza et al. (2000). The instrument is unidimensional, consisting of five items. This study utilized the Peruvian version validated by Caycho-Rodríguez et al. (2018), which employs a five-point Likert-type scale ranging from 1 (totally disagree) to 5 (totally agree). The scale demonstrates satisfactory evidence of internal structural validity (CFI = .99, GFI = .98, RMSEA = .71, SRMR = .01), validity in relation to other variables such as resilience ($r = .99, p < .01$) and depression ($r = -.58, p < .01$), and adequate reliability ($\alpha = .93, \omega = .93$).

Procedures

The research was approved by the Institutional Ethics Committee of Universidad Peruana Cayetano Heredia (N°211831). The scales were administered online over four months across eight organizations advocating for the rights of sexual minorities in Lima. Ethical standards for psychological research (American Psychological Association [APA], 2017) were followed, with participants providing informed consent and their anonymity ensured.

Data analysis

Statistical analyses were conducted using RStudio, version 4.3.3 (R Core Team, 2024). Preliminary analyses included the computation of descriptive and frequency statistics, along with an assessment of the reliability of the measurement scales. Data dimensionality was evaluated using the *psych* package (Revelle, 2024), with an exploratory factor analysis (EFA) based on a polychoric correlation matrix. The oblique rotation method (Oblimin) and the unweighted least squares extraction method (minimum residuals) were employed. Parallel analysis was used to determine the optimal number of factors. Fit indices considered in this analysis included the root mean square error of approximation (RMSEA), with expected values below .09, and the comparative fit index (CFI) and Tucker–Lewis index (TLI), both with values above .90 (Aldás & Uriel, 2017; Hu & Bentler, 1999).

Subsequently, item response analyses were conducted using the LTM (Rizopoulos, 2006) and MIRT (Chalmers, 2012) packages. A graded response model (GRM; Samejima, 1969) was employed to estimate the discrimination parameter and the corresponding difficulty parameters for each item. Two versions of the scale were evaluated: the first corresponded to the original version, which consisted of five items, while the second consisted of an abbreviated version that excluded item 5.

Results

Analysis of the descriptive statistics shows that the most frequently selected response for the first four items was 'agree' ($Mo = 4$), whereas for the fifth item, it was 'totally agree' ($Mo = 5$). This trend is supported by response distribution, with 'agree' representing 37.8% of total responses and 'totally agree' accounting for 25.8%. Additionally, the mean and standard deviation across all five items show minimal variation, with no significant skewness or kurtosis observed (Table 1).

Table 1
Descriptive statistics for SWLS

	M	SD	Mode	Range	Skewness	kurtosis
Item 1	3.66	1.12	4	1 - 5	-0.92	0.30
Item 2	3.58	1.07	4	1 - 5	-0.73	0.08
Item 3	3.76	1.20	4	1 - 5	-0.92	0.02
Item 4	3.71	1.17	4	1 - 5	-0.79	-0.11
Item 5	3.53	1.32	5	1 - 5	-0.54	-0.88

Prior to conducting the dimensionality analysis, the reliability of the scales was assessed. Both versions demonstrated satisfactory internal consistency and homogeneity: the original five-item ($\omega = .91$; $\text{astd} = .90$) and the four-item version ($\omega = .90$; $\text{astd} = .89$). The KMO and Bartlett's sphericity tests confirmed appropriate values for both the original version (KMO = .89, Bartlett's

$p < .001$) and the four-item version (KMO = .84, Bartlett's $p < .001$).

For the EFA, the original version produced an RMSEA of .08 (90% CI = .05-.13), while the four-item version yielded an RMSEA of .09 (90% CI = .04-.16). The latter exhibited a slight decline in model fit. Nevertheless, both models demonstrated adequate fit indices and factor loadings (Table 2).

Table 2
Exploratory Factor Analysis for both versions of the SWLS

	5-item version (original)			4-item version		
	F1	h^2	u^2	F1	h^2	u^2
Item 1	.81	.66	.34	.82	.67	.34
Item 2	.83	.70	.30	.85	.73	.27
Item 3	.84	.70	.30	.83	.70	.30
Item 4	.82	.67	.33	.80	.64	.36
Item 5	.78	.62	.39			
% exp. var.	66.90%			68%		
RMSEA	.08			.09		
CFI	.99			.99		
TLI	.98			.98		

Nota. h^2 : Communalidad; u^2 : Uniqueness.

Regarding the discrimination and difficulty parameters of both scale versions, item 5 displays a higher level of difficulty in distinguishing between participants with varying levels of the construct ($a = 2.25$). This item requires only a slight increase in the presence of the measured attribute for respondents to progress from one response category to the next. Specifically, challenges may arise in the differentiation of alternatives 2 (disagree) to 3

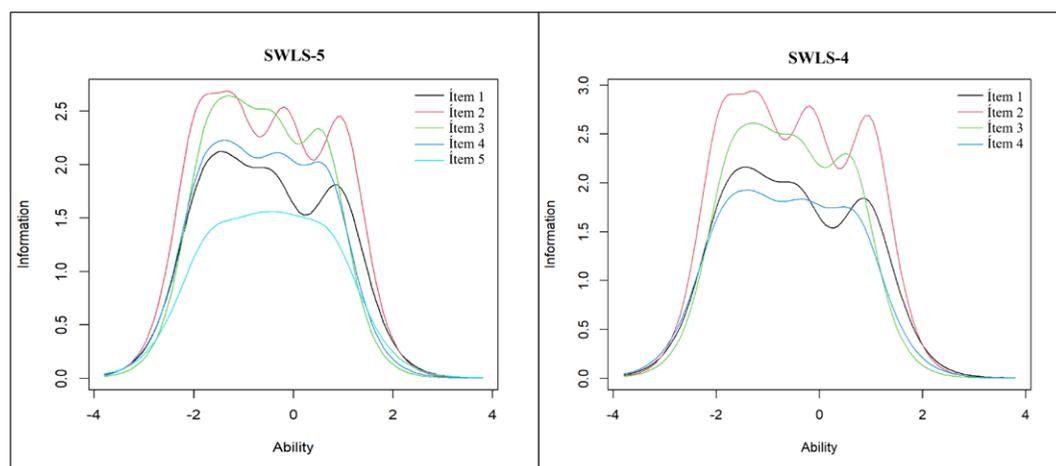
(neutral) ($b_2 = -0.80$) and 3 (neutral) to 4 (agree; $b_3 = -0.14$). In both versions of the scale, item 2 is the most sensitive in differentiating the levels of the measured attribute ($a = 3.09$; $a = 3.24$). In this item, a notable discrepancy is evident between parameters b_3 and b_4 , which indicate a greater challenge in advancing the marking of alternatives 4 and 5, which reflect a stronger presence of the measured attribute (Table 3).

Table 3*Discrimination and difficulty parameters for both versions of the SWLS*

	Discrimination parameter		Difficulty Parameter		
	a(SE)	b1(SE)	b2(SE)	b3(SE)	b4(SE)
SWLS-5					
Item 1	2.65 (.25)	-1.80 (.13)	-1.28 (.20)	-0.41 (.15)	0.89 (.27)
Item 2	3.09 (.31)	-1.92 (.13)	-1.19 (.22)	-0.18 (.17)	0.96 (.46)
Item 3	2.98 (.28)	-1.72 (.12)	-1.14 (.20)	-0.40 (.16)	0.59 (.16)
Item 4	2.74 (.26)	-1.80 (.13)	-1.18 (.21)	-0.29 (.15)	0.65 (.18)
Item 5	2.25 (.21)	-1.66 (.13)	-0.80 (.16)	-0.14 (.12)	0.70 (.19)
SWLS-4					
Item 1	2.68 (.26)	-1.80 (.13)	-1.27 (.21)	-0.41 (.16)	0.90 (.29)
Item 2	3.24 (.35)	-1.89 (.13)	-1.17 (.24)	-0.18 (.18)	0.96 (.55)
Item 3	2.96 (.30)	-1.71 (.12)	-1.14 (.21)	-0.41 (.16)	0.59 (.16)
Item 4	2.54 (.25)	-1.84 (.14)	-1.21 (.22)	-0.30 (.16)	0.67 (.18)

The item information curves of the two versions of the scale indicate items two and three provide the highest levels of information at both the lower ($I(\theta) \approx 2.5$, $\theta \approx -2$) and upper ($I(\theta) \approx 1.5$) ends of the measured attribute spectrum. These items were the most informative across a broader range of ability levels compared to

other items. In contrast, items one and four offer slightly less information, with peaks around $\theta \approx 2.0$. Consistent with previous findings, item five provides the least information and does not exhibit any notable peaks for the varying levels of the measured attribute (Figure 1).

Figure 1. Item information curves of both versions of the SWLS.

In the characteristic curves for the 4- and 5-item versions of the scale, alternative 1 (strongly disagree) and 5 (strongly agree) exhibit the highest probability of being selected at the lowest and highest levels of the construct, respectively. In items 1, 3, and 4, it is observed that alternative 2 (disagree) exhibits its maximum probability of being selected at an ability level proximate to -1. Although this alternative is more likely to be selected by subjects

with slightly below-average ability, its overlap with alternatives 1 (strongly disagree) and 3 (neutral) indicates that it does not effectively discriminate in this ability range. Ultimately, in item 5, alternative 3 (neutral) is unable to effectively differentiate between superior or inferior ability levels due to its overlap with alternatives 2 (disagree) and 4 (agree; see Figures 2 and 3).

Figure 2. Item Characteristic Curve of the SWLS-5 (original version).

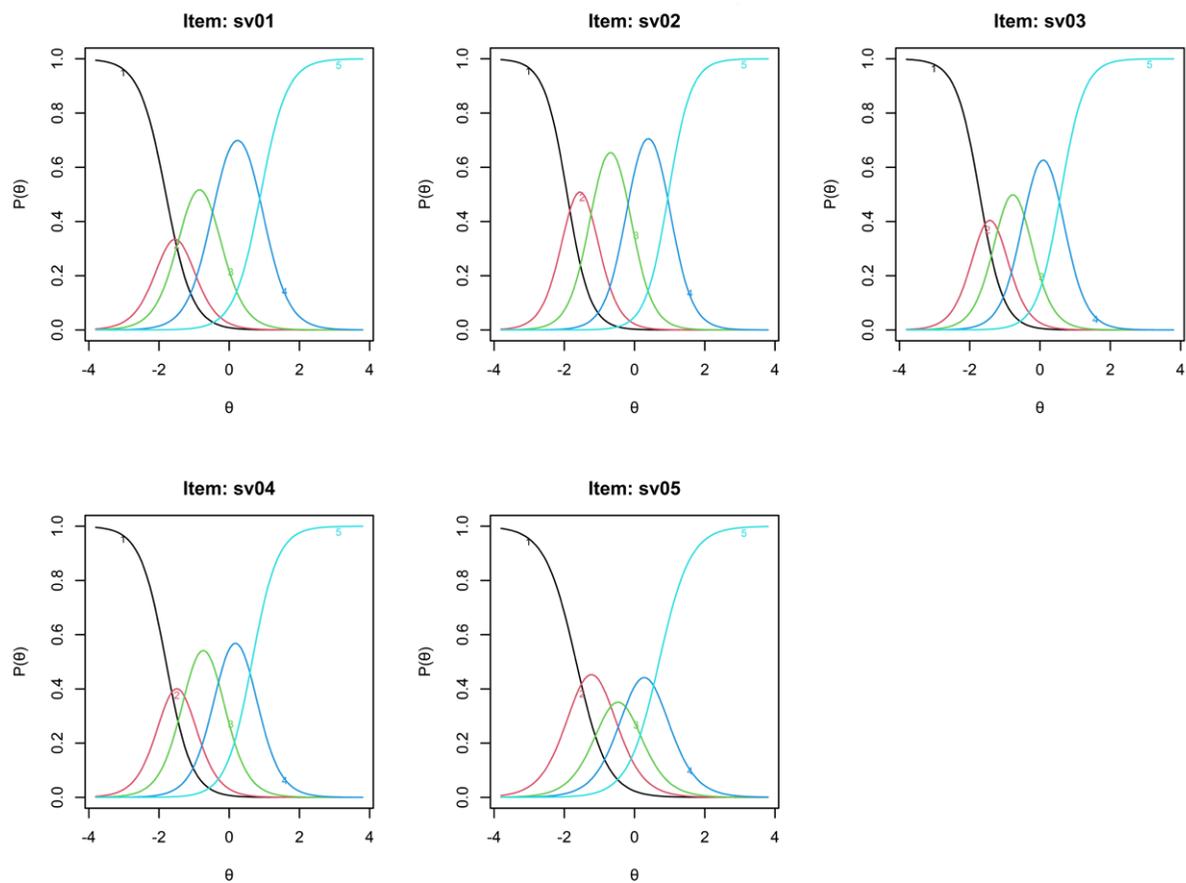
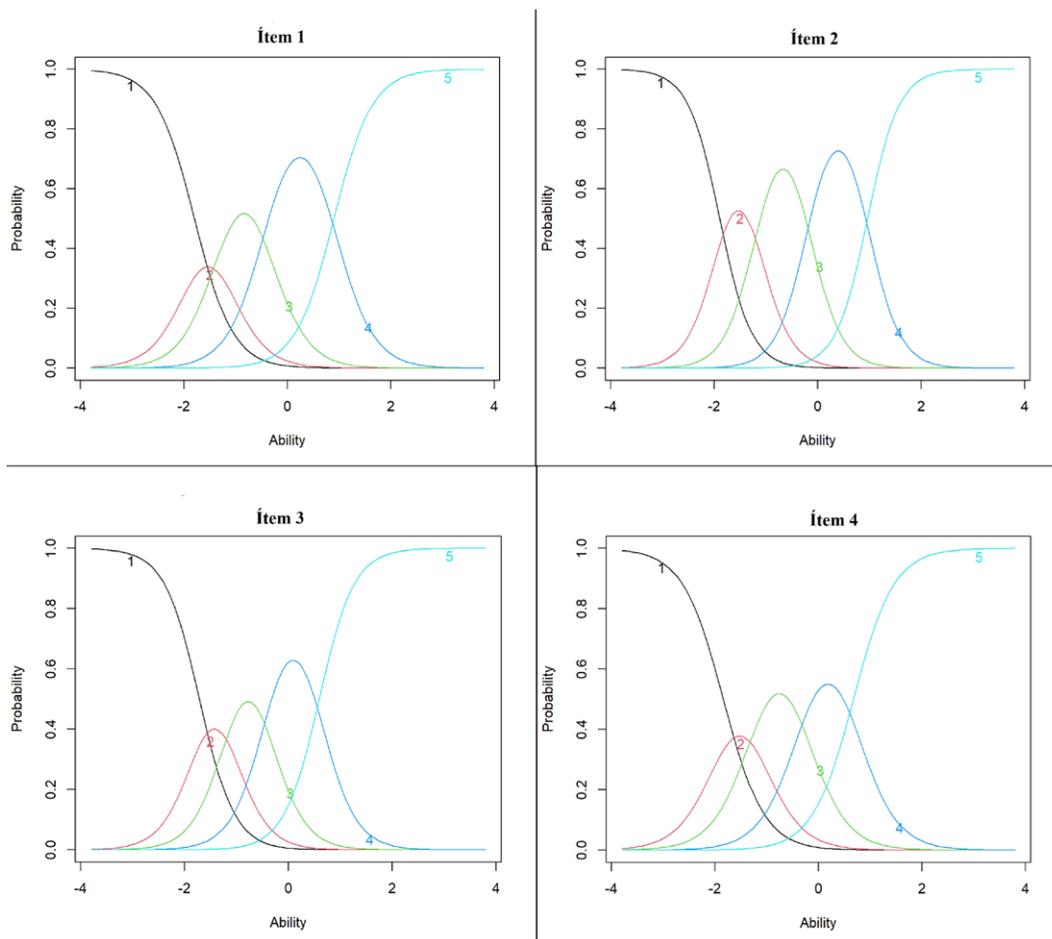


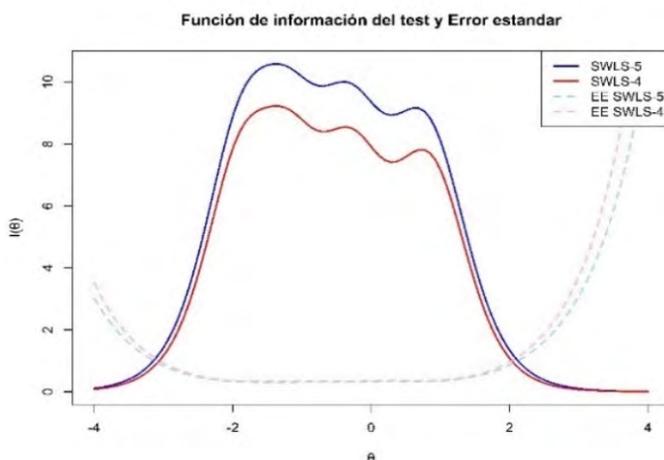
Figure 3. Item Characteristic Curve of the SWLS-4.



The information provided by the five-item version of the scale reaches its maximum peak in the ability range of -2 to 1, demonstrating greater accuracy for measuring abilities within that range.

The 4-item version provides less information yet remains relatively accurate within the same ability range as the previous one, albeit with a reduced magnitude of information (Figure 4).

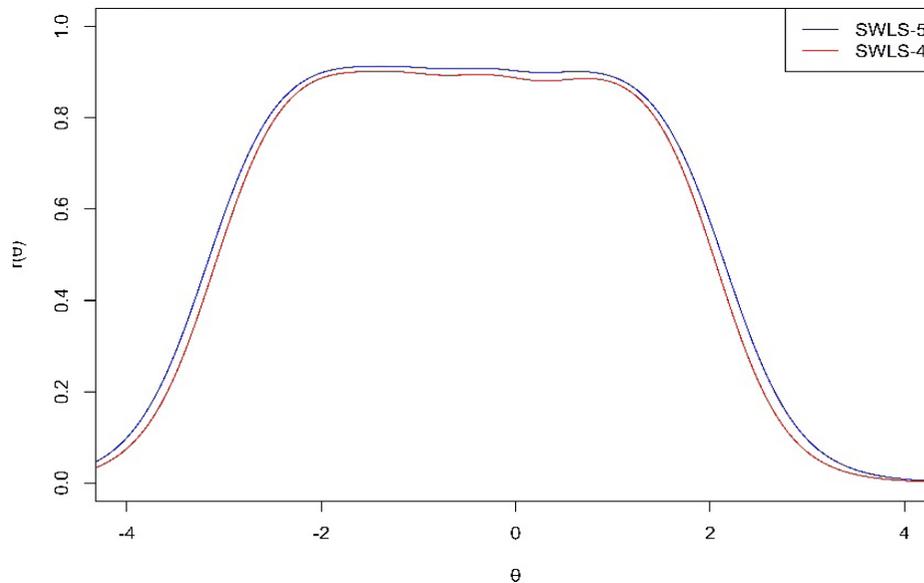
Figure 4. Test information function and standard error of both versions of the SWLS.



The conditional reliability of the two versions of the instrument demonstrates satisfactory coefficients at the -2 to 2 ability levels, with values exceeding 0.80 in both cases. Reliability is reduced at the upper and lower limits of the scale,

indicating inconsistency in identifying subjects with extremely low or extremely high levels of the construct. However, reliability is maintained at high, moderate, and low levels (Figure 5).

Figure 5. Conditional reliability of both versions of the SWLS scale.



Discussion

The present study examined two unifactorial structures of the life satisfaction scale. Initially, it was observed that both versions demonstrated adequate fit. Nevertheless, an examination of the RMSEA confidence intervals reveals a slight variation in the coefficients for the 4-item version. This could be an indication that the elimination of item 5 does not significantly affect the structure of the scale. This finding is consistent with previous research (Atienza et al., 2000; Calderón-De la Cruz et al., 2018; Caycho-Rodríguez et al., 2018; Clench-Aas et al., 2011; Diener et al., 1985; Kjell & Diener, 2021; Jovanović, 2016; Jovanović et al., 2022; Moksnes et al., 2014; Pavot & Diener, 2008). Accordingly, the exclusion of this item would not impact the internal structure of the instrument; however, it could affect the measurement of the life satisfaction construct.

The discrimination and difficulty parameters demonstrates that items 2 “The conditions of my life are excellent” and 3 “I am satisfied with my life” have the most effective discrimination levels in comparison to item 5 “If I could live my life over again, I would change almost nothing”, which exhibits the lowest level of discrimination. These results may be explained by considering the connotations of the phrases in question. On the one hand, items 2 and 3 address fundamental elements of the life satisfaction construct, whereas item 5 focuses on retrospective assessments framed in a counterfactual manner (Kjell & Diener, 2021). This situation makes it challenging to identify the central response alternatives, as evidenced by the shift from “disagree” to “neutral” ($b_2 = -0.80$) as well as from “neutral” to “agree” ($b_3 = -0.14$) and would generate a predominance of extreme responses.

Upon examination of the characteristic curve for item 5, it becomes evident that the alternatives “disagree”, “neutral”, and “agree” exhibit substantial overlap. It may therefore be necessary to either revise these response options or modify the counterfactual wording of item 5 in order to increase the levels of discrimination between the levels of ability in the central response options. One potential solution that aligns with Hanzlová (2022) proposal is to maintain a dichotomous or reduced alternatives structure without a neutral value. This approach could be beneficial as it allows for a more effective differentiation between the extremes of the life satisfaction scale, which consistently demonstrate superior performance in terms of attribute discrimination.

The 5-item version (SWLS-5) consistently provides more information than the 4-item version (SWLS-4) across the ability range, especially between -2 and 1. This suggests that the addition of the fifth item improves slightly the test's ability to discriminate in that range, making it more accurate in measuring life satisfaction considering its temporality (Kjell & Diener, 2021; Hanzlová, 2022; Nima et al., 2020). Nonetheless, both versions (SWLS-5 and SWLS-4) are suitable for evaluating the construct in individuals with ability levels within this range. This conclusion is supported by the coefficients obtained in the conditional reliability analysis. In this instance, if the objective is to assess individuals with the aforementioned abilities with greater accuracy, the 5-item version appears to be the superior choice. However, if the objective is to achieve a balance between test length and accuracy, the 4-item version may be an adequate alternative, although with lower accuracy.

The topic of sexual minorities has been the focus of considerable interest among researchers, with the majority of studies concentrating on the negative psychological implications associated with sexual orientation. Thus, the validation of instruments that assess positive psychological variables, as life satisfaction, represents a significant advancement in the field of positive psychology.

In practical terms, the four-item version may be employed for large-scale applications where a retrospective meta-evaluation of the construct is not required (Kjell & Diener, 2021). However, if the objective is to evaluate satisfaction with life in the present and past, it is recommended to use the original five-item version, as it can be more consistent over time. The results of the IRT analysis indicate that there is sufficient psychometric evidence to support the use of both the original version (SWLS-5) and the shortened four-item version (SWLS-4).

In terms of limitations, this study employed non-probabilistic convenience sampling, which restricts the generalizability of the findings to the broader population of gay individuals in Peru. However, the results are significant insofar as mental health professionals utilize the SWLS as a screening tool and shape their mental health promotion and intervention strategies from a well-being perspective. The participants were recruited from organizations advocating for the visibility and rights of sexual minorities in Lima. Consequently, it is recommended that the SWLS be validated in other sociocultural contexts. Additionally, the study had limited representation of lesbian women, highlighting the need for future research to examine whether the SWLS retains its psychometric properties in this population and among other sexual minority groups.

Declaration of Interests

The authors declare no conflict of interest, as this article has no commercial or financial objectives.

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