

■ Pictorial adaptation of the Subjective Well-Being Scale: A bayesian approach to confirmatory factor analysis

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Abstract

This study aimed to adapt the Subjective Well-Being Scale (SWB-3) for use with Peruvian children, using a Bayesian approach to ensure its accuracy and reliability. The scale, which includes visual items to assess well-being, was shown to be effective, reflecting a consistent unidimensional structure. The results revealed a preference for positive responses, especially on items indicating high levels of happiness, suggesting a natural inclination toward optimism among children. Bayesian confirmatory factor analysis (BFCA) indicated excellent fit characteristics, and the SWB-3 demonstrated good reliability with an omega coefficient of .86. The study highlighted the predictive power of the SWB-3 for depression with a large direct relationship ($r = .55$) which is in line with previous research. However, methodological limitations such as non-probability sampling and lack of exploration of other variables such as anxiety suggested areas for future research. Overall, the study provides a validated tool for assessing the subjective well-being of children in Peru, crucial for informing policy and improving the overall well-being of children.

Keywords: child subjective well-being, pictorial adaptation, bayesian confirmatory factor analysis, psychometric properties, bayesian approach.

Resumen

Adaptación pictórica de la Escala de Bienestar Subjetivo: Un enfoque bayesiano para el análisis factorial confirmatorio. Este estudio tuvo como objetivo adaptar la Escala de Bienestar Subjetivo (SWB-3) para su uso con niños peruanos, utilizando un enfoque bayesiano para asegurar su precisión y fiabilidad. La escala, que incluye ítems visuales para evaluar el bienestar, demostró ser efectiva, reflejando una estructura unidimensional consistente. Los resultados revelaron una preferencia por respuestas positivas, especialmente en ítems que indican altos niveles de felicidad, lo que sugiere una inclinación natural hacia el optimismo entre los niños. El análisis factorial confirmatorio bayesiano (BFCA) indicó excelentes características de ajuste, y el SWB-3 demostró buena fiabilidad con un coeficiente omega de .86. El estudio destacó el poder predictivo del SWB-3 para la depresión con una gran relación directa ($r = .55$) que está en línea con investigaciones previas. Sin embargo, limitaciones metodológicas como el muestreo no probabilístico y la falta de exploración de otras variables como la ansiedad sugirieron áreas para futuras investigaciones. En general, el estudio proporciona una herramienta validada para evaluar el bienestar subjetivo de los niños en Perú, crucial para fundamentar políticas y mejorar el bienestar general de los niños.

Palabras clave: bienestar subjetivo infantil, adaptación pictórica, análisis factorial confirmatorio bayesiano, propiedades psicométricas, enfoque bayesiano.

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Highlights

- A pictorial adaptation of the SWB 3 was developed and validated with Peruvian children using expert review and cognitive interviews to ensure content validity.
- Bayesian CFA confirmed a clear unidimensional structure, yielding excellent fit indices and high reliability.
- The pictorial SWB 3 demonstrated strong criterion validity, correlating negatively with depressive symptoms, supporting its utility as a screening tool.

Puntos clave

- La versión pictórica de la SWB 3, adaptada para niños peruanos de 8 a 12 años, empleó revisión de expertos y entrevistas cognitivas para garantizar la validez de contenido.
- El Análisis Factorial Confirmatorio Bayesiano corroboró una estructura unidimensional clara, con excelentes índices de ajuste y alta fiabilidad.
- La escala pictórica SWB 3 mostró fuerte validez criterio, correlacionándose negativamente con síntomas depresivos, lo que respalda su uso como herramienta de detección.

Subjective well-being, understood as the extent to which individuals positively assess their lives and experience satisfaction (Dagger & Sweeney, 2006), constitutes a critical aspect of childhood, as it encompasses both quality of life and daily satisfaction (Casas & González-Carrasco, 2019). In fact, subjective well-being can be influenced by family, friends, school, extra-curricular activities, physical and emotional health, among other factors (Cabieses et al., 2020). Since these various factors relate to the experience and evaluation of happiness, satisfaction, and well-being (Sabato & Kogut, 2019; Vaqué-Crusellas et al., 2023), subjective well-being becomes an essential element to obtain meaningful data related to holistic development (Li et al., 2022) and to understand the emotional, social, and psychological aspects of an individual (Ye et al., 2020).

The definition of subjective well-being is not easy to understand, because it has many definitions. However, it often refers to the extent to which individuals assess their lives as fulfilling (Diener, 1984). Indeed, this assessment might be purely cognitive, emotional, or a blend of the two (Diener et al., 1997). In the context of children, positive or negative subjective well-being has a significant impact on various aspects of their daily lives (Schutz et al., 2022). For example, the lack of subjective well-being is linked to the prevalence of mental health problems, including anxiety and depression (Goryczka et al., 2022; Guney et al., 2010; Lopes & Nihei, 2021; Singh & Raina, 2020), as well as manifestations of problematic behavior, social isolation (Novoa et al., 2021), and academic difficulties (Tomy et al., 2020). In contrast, elevated levels of subjective well-being appear to fuel the development of emotional regulation skills (Katsantonis et al., 2023), cultivate empathy (Chai et al., 2019) and reinforce resilience (Pongutta & Vithayarungruangsri, 2023). Beyond these individual gains, a strong sense of well-being also underpins healthier interpersonal relationships (Villanueva et al., 2022) and correlates with enhanced academic outcomes (Wu & Becker, 2023).

Childhood well-being proves vulnerable to multiple threats. Family instability represents a significant risk factor. Exposure to violence or trauma (Sarriera et al., 2021) and physical or mental health challenges (Pickett et al., 2022) similarly compromise a child's sense of security. Ortuño-Sierra et al. (2020) demonstrate how these adversities progressively undermine both social cohesion and academic engagement: peer relationships deteriorate, academic performance declines (Albarado et al., 2022), bullying risks increase (Borualogo &

Casas, 2023), and essential skills such as decision-making and conflict resolution become impaired.

Although targeted research on younger children remains somewhat limited, adolescence emerges as a particularly critical developmental window. Across diverse cultural settings, studies consistently reveal an inverse relationship between subjective well-being and depressive symptoms. Brazilian adolescents showed a strong negative correlation ($r = -.61$; Patias et al., 2017), with Pinto et al., (2018) reporting nearly identical findings at $r = -.62$. Comparable patterns emerge among Chinese vocational students ($r = -.55$; Ouyang et al., 2021), while Indian adolescents demonstrate a moderate inverse association ($r = -.37$; Park et al., 2023). These correlations emphasize the significance of depression in understanding subjective well-being and reinforce the importance of addressing these clinical disorders to enhance mental health (Whitehead et al., 2019).

In this sense, the study of subjective well-being presents some challenges, one of them is the limited specialized tools available to measure this construct (Educación et al., 2021). For instance, one of the few instruments is the Scale of Perception of Well-Being Indicators (SPWI). Although this scale includes questions about subjective well-being, they make up only a part of its 80 items (Asencio et al., 2014). Therefore, it does not fully focus on exploring how the individual feels but is part of a broader concept, not delving into subjective well-being as an independent and central construct. On the other hand, there is the Children Well-Being Scale (CWBS), which, while being a short test composed of 12 items, still encompasses a multidimensional view, exploring self-concept, life satisfaction, and resilience factors (Vinaccia-Alpi et al., 2020). Savahl et al. (2021) build on this by demonstrating, through a CFA of over 90,000 children across 35 countries, that a hierarchical model of global satisfaction, domain satisfaction, and affect can more precisely capture children's subjective well-being than purely unidimensional scales. Consequently, subjective well-being is commonly measured through self-report scales centered on personal evaluations and experiences (Diener et al., 2018), which justifies the existence of tools like SPWI and CWBS, as well as shorter and more specific instruments like the Subjective Well-being Scale, which provides a one-dimensional and global assessment of subjective well-being according to those indicated by Lyubomirsky and Lepper (1999).

The Subjective Well-Being Scale (SWB-3; Sun et al., 2016), has its origin within a more complex theoretical framework,

and is enriched with three essential questions inspired by the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), to capture a broader assessment of satisfaction with life (Diener, 1984). The subjective assessment of an individual's life may rely on cognitive, emotive, or a combination of both dimensions (Diener et al., 1985). The SWB-3 uses happiness as a positive affective component, but also involves the cognitive component through life satisfaction, where both elements explain the subjective well-being of individuals (Moyano and Ramos, 2007). Taking into account this framework, subjective well-being is a cognitive and affective process (Ventura-León et al., 2023). Through an initial examination by Sun et al. (2016), the robust reliability of SWB-3 is known, crystallized not only in Cronbach's alpha ($\alpha = .87$) but also in the confidence provided by the composite reliability known as CR (.88). Although its exploration has been limited, SWB-3 has demonstrated good reliability, with indicators fluctuating between .79 and .94 in various settings (Lyubomirsky & Lepper, 1999), surpassing the desired threshold of .80 ($\alpha = .87$; Su et al., 2016), and occasionally exceeding 0.90 ($\alpha = .93$; Su et al., 2018).

SWB-3 aligns with the recent trend in mental health to focus on positive characteristics rather than psychopathological aspects of individuals, emphasizing the relevance of subjective well-being (Lucas, 2018; Lui & Fernando, 2018). Moreover, this scale corresponds to the increasing fascination with discerning attributes of a desirable existence and directing individual or societal endeavors, such as the formulation of governmental strategies (Diener et al., 2009). The relationship between subjective well-being and socioeconomic status, especially in economically less developed countries with lower education levels, highlights the importance of this construct (Howell & Howell, 2008). Therefore, the adaptation of the Subjective Well-Being Scale into a pictorial format and its analysis through a Bayesian approach to confirmatory factor analysis is not only relevant from an academic perspective but also socially, offering a more accessible and easily interpretable tool for various population groups.

In this research, we take SWB-3 a step further by adding images, a step that enhances children's attention capture. In fact, significant studies indicate that children easily engage with visual elements (Ernst et al., 1994; Valla et al., 2000), even allowing four-year-olds to identify and express various emotions (Eisenberg et al., 1997). Pictorial scales, such as the adaptation of the GAD-7 in children validated in Peru (Ventura-León et al., 2024), have been shown to be effective in overcoming language barriers and simplifying complex concepts, increasing the accuracy and coherence of responses. Furthermore, their responses become more consistent because, by reflecting daily situations, images help children show how they behave in real life (Maćkiewicz & Ciecuch, 2016). In summary, the drawings are not just decorations; they are keys to better understanding the evaluated children.

In recent years, the field of instrument validation has witnessed a surge in Bayesian approaches (Muthén & Asparouhov, 2012). In our view, this study breaks new ground in Latin America by harnessing Bayesian techniques for psychometric evaluation. Unlike traditional frequentist methods, Bayesian Confirmatory Factor Analysis (BCFA) explicitly models uncertainty and integrates prior knowledge with observed data, thereby enhancing both flexibility and precision (Ribeiro et al.,

2021). Such gains become particularly evident when sample sizes are small or datasets limited, scenarios where frequentist frameworks often falter (Merkle & Rosseel, 2018).

Further strength lies in the introduction of novel fit indices, namely, BRMSEA (Bayesian RMSEA) and BCFI (Bayesian CFI). Take BRMSEA, for example: as a Bayesian counterpart to the classic RMSEA, it maintains its accuracy regardless of sample size, sidestepping the large-sample assumptions that can bias the frequentist RMSEA (Hoofs et al., 2018). Likewise, estimating reliable confidence intervals for indices like CFI remains challenging under a purely frequentist paradigm, since their sampling distributions are not well defined (Ribeiro et al., 2021).

Additionally, the Bayesian paradigm enables the computation of credibility intervals that directly express the likelihood of containing the true parameter value unlike the frequentist 95% confidence interval, which is based on repeated sampling assumptions (Fornacon-Wood et al., 2022). Traditional hypothesis testing using p-values is frequently misunderstood, as rejecting the null hypothesis does not confirm the truth of the alternative hypothesis (Gao, 2020); furthermore, with sufficiently large samples, the null hypothesis is almost invariably rejected if the alpha level of 5% is not satisfied (Lin et al., 2013). These considerations highlight BCFA's potential as a robust alternative for psychometric research, particularly when working with limited or difficult-to-access populations (Ribeiro et al., 2021).

The current study seeks to validate and examine the reliability of an illustrated version of the Subjective Well-Being Scale (SWB-3) specifically adapted for Peruvian children through a Bayesian analytical approach. This investigation serves a dual purpose: it establishes the scale's cultural appropriateness while simultaneously providing rigorous evaluation of its measurement consistency and precision among young participants. The study leverages Bayesian analysis to offer comprehensive, context-sensitive assessment that accounts for the unique characteristics of this population.

Method

Participants

Overall, 783 students from Metropolitan Lima, Peru, took part in the study. Their ages spanned from 8 to 12 years, with a mean of 10.28 years ($SD = 1.26$). In terms of the gender distribution of participants, there was a nearly equivalent number: 54.5% were girls, and 45.5% were boys. The sample consisted of third grade (20.10%), fourth grade (23.90%), fifth grade (21.20%), and sixth grade (34.90%) primary education students. To ensure appropriate participant selection, inclusion criteria required children to be 8–12 years old, enrolled in grades 3–6 of primary education in Metropolitan Lima schools, and to have provided both parental informed consent and child assent; conversely, exclusion criteria eliminated any child with diagnosed cognitive impairments that would preclude comprehension of the pictorial scale, those without parental consent, or any child who refused to participate. The required sample size was estimated by targeting at least 10 times the number of items (Morales-Vallejo, 2013). As a result, the study had 261 participants per item, a sufficiently large number for

the test's length. In response to post-pandemic constraints, we employed non-probabilistic convenience sampling to facilitate data collection (Maxwell, 2012).

Data collection

Sociodemographic questionnaire. To gather essential demographic details, we developed a concise questionnaire that captured each participant's age, gender, and educational level.

The Subjective Well-Being Scale (SWB-3; Su et al., 2016) is designed as a concise, three-item measure of life satisfaction, with respondents indicating their agreement on a five-point Likert scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*). Total scores span from 5 to 15, where higher values reflect greater subjective well-being. In the Peruvian context, an adult version of the SWB-3 has also been validated (Ventura-León et al., 2023). Notably, both the original and the culturally adapted formats of the SWB-3 have shown consistently high reliability across diverse samples. The data it collects is very reliable, with a reliability coefficient (ω) of .90. Furthermore, the data's quality is exemplified by a flawless root mean square error of approximation (RMSEA) of .00 and a robust comparative fit index (CFI) of 1.00. If one requires the child-friendly version, it can be conveniently located within the Appendix.

The Patient Health Questionnaire (PHQ-8; Kroenke et al., 2009) is a nine-item measure using a scale from 0 to 3 (0 = *Not at all*, 1 = *Several days*, 2 = *More than half the days*, 3 = *Nearly every day*) to evaluate depressive symptoms. This scale originally had nine items; however, for the purposes of this research, item 9, which refers to suicidal ideation, has been omitted as ethically inappropriate in the context of children. It provides a singular measure of depression intensity, where higher scores indicate greater severity of depression. PHQ-8 is validated and reliable in different contexts (Arias de la Torre et al., 2023), evidenced by a Cronbach's alpha of .89.

Procedure

Regarding the illustrated adaptation, this study considered other child research where psychometric tests with images were used (Dubí & Schneider, 2009; Harter & Pike, 1984; Ruocco et al., 2018; Tietjens et al., 2018). In fact, two child psychology professionals advised on the design of the images. Subsequently, a professional illustrator was hired to create gender-neutral characters, a decision made based on prior information (Bustos et al., 2009; White, 2014). Following PROMIS® pediatric standards, we also conducted a systematic literature review, expert-panel consultation, and child cognitive interviews to ensure exhaustive content coverage of all well-being facets (Ravens-Sieberer et al., 2014). These steps provide initial evidence based on content, although the Standards for Educational and Psychological Testing (American Educational Research Association et al., 2014) and COSMIN recommendations (Sireci & Faulkner-Bond, 2014) advise panels of 5–10 experts for full content-evidence assessments, a scope we recommend expanding in future studies.

Finally, a pilot study involving ten eight-year-olds assessed the comprehension and clarity of the illustrations. The main study was conducted from October to December 2023 and each session lasted approximately 15 minutes. The database is available at OSF repository: <https://osf.io/j4b7h/>

Ethics

Before commencing the study, ethical considerations were meticulously reviewed in accordance with the Declaration of Helsinki (World Medical Association, 1964) and guidelines for online research (Hoerger & Currell, 2012). The Research Ethics Committee of the Universidad Privada del Norte (UPN) of Peru approved this project with the rectoral resolution number: N° 0012023. Informed consent was obtained from all individual participants included in the study.

Data analysis

All statistical work was performed in R programming language via RStudio environment version 2024.9.0.375 (RStudio Team, 2024). We built our analysis around two primary packages: 'blavaan' (Merkle & Rosseel, 2018) and 'Bayesrel' (Pfadt et al., 2023). Several supporting tools proved essential 'tidyverse' (Wickham, 2019), 'careles' (Yentes & Wilhelm, 2023), and 'PsychMetricTools' (Ventura-León, 2024).

For model convergence, we employed Markov Chain Monte Carlo (MCMC) methods (Brooks & Gelman, 1998). Three chains ran simultaneously. Each chain completed 2,000 iterations; we discarded the initial 1,000 samples as burn-in period. Our convergence strategy involved dual assessment procedures: trace plot examination to verify overlap consistency and stationarity, followed by Potential Scale Reduction Factor (PSRF) monitoring. Values near 1.0 signal successful convergence, while elevated values indicate insufficient iterations (Brooks & Gelman, 1998). Effective sample size (ESS) calculations evaluated sampling efficiency, with our target being 300 effective draws minimum per chain (Vehtari et al., 2021).

Fit evaluation started with Posterior Predictive P-value (PPP). Values near 0 or 1 reveal poor model-data alignment; values around .50 indicate good correspondence (Gelman et al., 2014). However, PPP shows oversensitivity in large samples. Therefore, we included Bayesian Comparative Fit Index (BCFI) and Bayesian Root Mean Square Error of Approximation (BRMSEA). Our criteria: BCFI > .95 and BRMSEA < .08 for acceptable fit (Hoofs et al., 2018; Muthén & Asparouhov, 2012). Dimensionality examination employed Bayes Factor (BF). The Laplace-approximated log-Bayes Factor (logBF) quantified evidence strength across competing models (Lewis & Raftery, 1997; Wetzels & Wagenmakers, 2012).

Reliability assessment involved McDonald's omega calculations. We extracted median values plus credibility intervals from posterior distributions (Pfadt et al., 2023). This Bayesian approach draws on prior information instead of relying on frequentist p-values, which vary with sample size (Fornacon-Wood et al., 2022). Individual item contributions to overall consistency were examined through posterior density plots generated via Bayesrel package, arranged by Kullback-Leibler divergence (KL; Gibbs & Su, 2002; Kullback & Leibler, 1951). Posterior Predictive Checks (PPC) evaluated one-dimensional model fit by comparing observed eigenvalues against 95% credibility intervals. Good fit and one-dimensionality were confirmed through appropriate eigenvalue patterns. Convergence was verified through trace plots showing sampling chain convergence, indicating stable reliability estimates.

Given that a factor structure with three is highly likely to have a good fit, it is necessary to consider other forms of validity, such as evidence of validity in relation to another variable in the convergence mode. First, a structural equation analysis using BCFA was used to examine the relationships between various concepts (Raykov & Marcoulides, 2006), overcoming simple correlation methods by adjusting for item weights, measurement errors and proxy variables. In this regard, the PHQ-8 depression scale was chosen as an indicator of convergence based on previous research (Ouyang et al., 2021; Park et al., 2023; Patias et al., 2017; Pinto et al., 2018).

Results

Model convergence

The one-factor model's convergence was evaluated with Markov Chain Monte Carlo (MCMC) chains, discarding the first 1000 iterations as burn-in. Figure 1A shows that the traces of the three MCMC chains overlap and remain stationary, without patterns, demonstrating convergence towards the

same posterior distribution of loadings and variances. The Gelman-Rubin statistics, with a PSRF near 1.00, and a minimum ESS of 1298.958 (surpassing the 300 threshold) confirm convergence and high sampling efficiency, validating the reliability of Bayesian estimates for data inference (See Table 1).

In Figure 1B, the posterior distribution of BRMSEA and BCFI for the one-factor model is examined, indicating a good fit. In fact, it is observed that the BCFI values are close to perfection, and the BRMSEA values are predominantly below the threshold indicating a good fit ($BRMSEA < .08$).

The Monte Carlo standard errors (MCSE) for the single-factor model ranged from 3.14×10^{-4} to 8.64×10^{-4} , with all MCSE values for the parameters remaining below 5% of the posterior standard deviation.

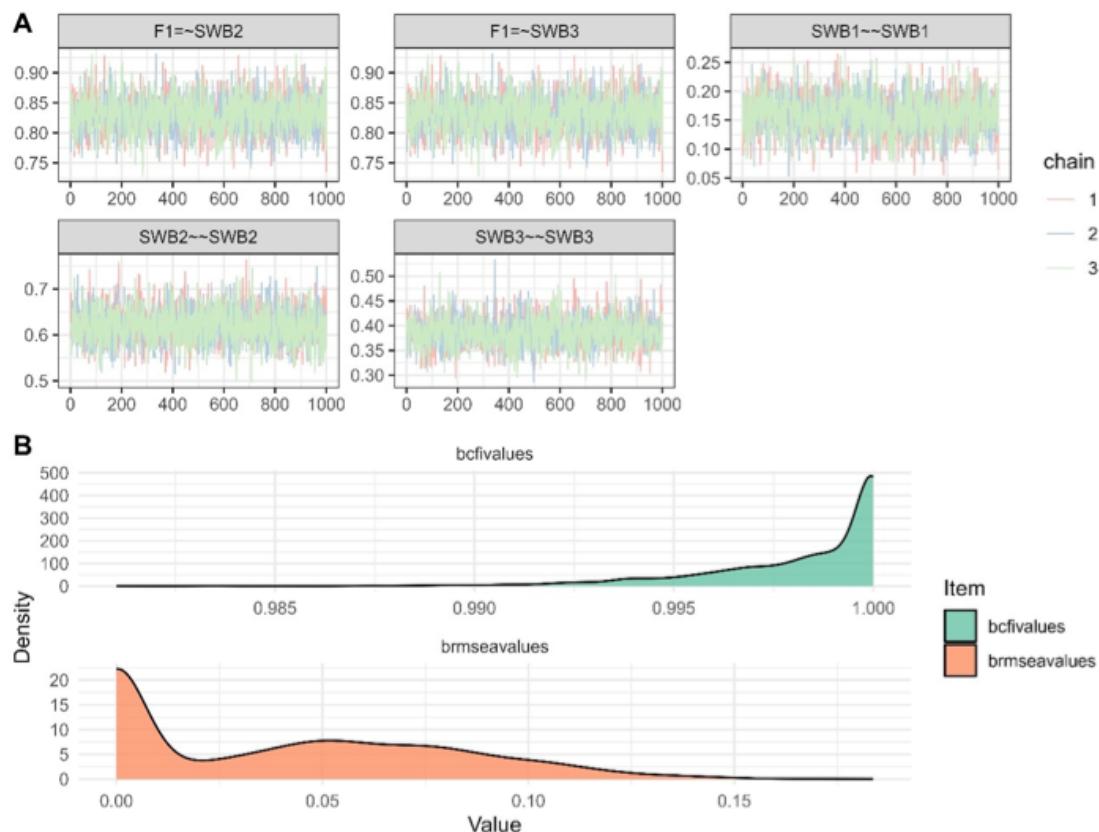
In Table 1, it can be observed that all factorial loadings in the posterior mean ranged from .80 to .93, which can be considered high. Furthermore, the 95% credibility intervals reveal that in all the posterior distributions, these loadings fall within this same category. Therefore, the one-dimensional structure of the SBW-3 was confirmed as an appropriate measurement model. Additionally, Table 1 presents the response rates for

Table 1. Preliminary analysis and estimated parameter information.

Items	Response rate					Factor	Posterior Mean	95% CrI	PSRF
	1	2	3	4	5				
1	3.58	4.60	22.09	25.03	44.70	SWB1	0.930	[0.900, 0.961]	–
2	5.36	10.60	27.71	25.93	30.40	SWB2	0.729	[0.694, 0.761]	1.000
3	2.55	4.73	18.90	28.35	45.47	SWB3	0.802	[0.771, 0.835]	1.000

Note. Estimated Potential Scale Reduction Factor (PSRF), CrI, 95% Credibility Intervals; Posterior Mean; Posterior Mean: is the average of the posterior distribution of the reliability estimate.

Figure 1. Convergence and Model Fit Plots



each of the categories, showing a trend towards high scores; specifically, response rates are higher than 20% from an alternative 3 onwards.

Factorial structure

Examination of the Posterior Predictive Probability (PPP) value in the evaluated model revealed a value of .36. Since the PPP is closer to 50% than to 0%, it could be considered that the model has reasonably good fit. However, as the PPP can be overly sensitive to minor model misfit, especially in large samples like ours, other evaluations were conducted using fit indices such as Bayesian Root Mean Square Error of Approximation (BRMSEA) and Bayesian Comparative Fit Index (BCFI). The initial single-factor model evaluated showed a BRMSEA of .039 with a 95% credibility interval ranging from .000 to .108 and a BCFI of .998 with a 95% credibility interval of .993 to 1.000. This suggests an excellent fit.

Dimensionality

The dimensionality of the study is decisively supported by the Bayes Factor, which shows strong support for the one-factor model compared to the null model ($BF_{01} = -585.950$). This

negative magnitude of the Bayes Factor, much greater than the conventional threshold for strong evidence, decisively confirms the superiority of the one-dimensional model over a null one in terms of fit and predictive accuracy.

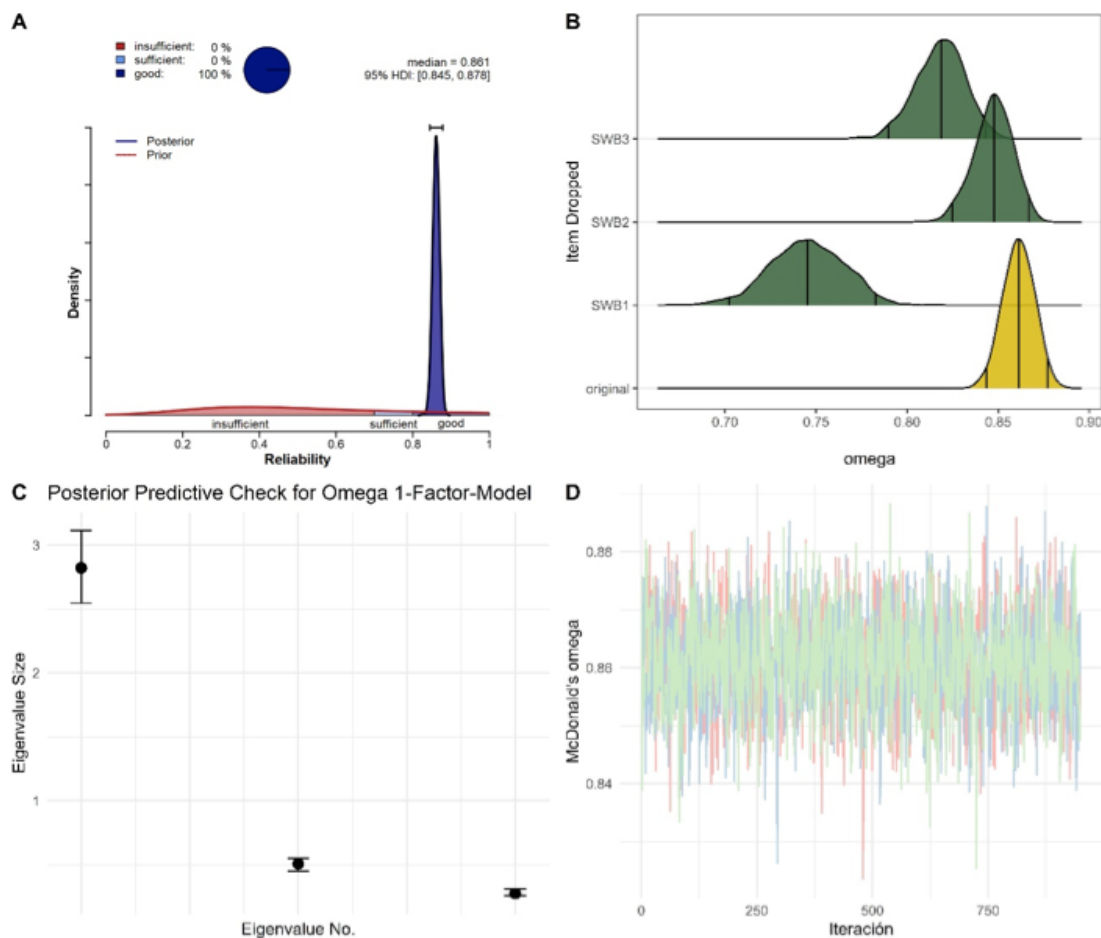
Reliability

Figure 2A shows the omega reliability coefficient's distribution, with the posterior (blue) indicating "good" reliability and a median value of .861. Figure 2B's density plots reveal no items decrease reliability, as none shift right from the original distribution. Figure 2C indicates a one-factor model fit, with a dominant first eigenvalue and diminishing subsequent values. Lastly, Figure 2D's convergence plot for McDonald's ω illustrates consistent MCMC chain convergence, suggesting stable reliability estimates.

Evidence in relation to another variable

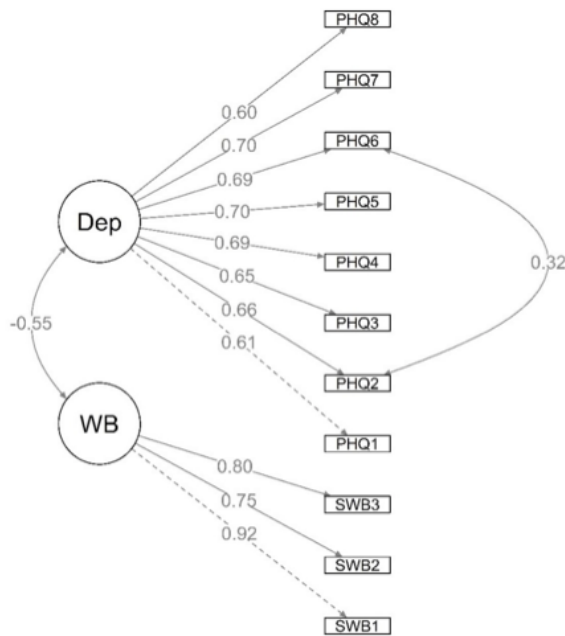
Figure 3 shows the relational model. Prior to its interpretation, the goodness-of-fit measures were reviewed and found to be optimal ($BCFI = .93$; $BRMSEA = .05$). In a Bayesian confirmatory factor analysis, Depression (Dep) and Well-being (WB) were negatively correlated ($-.55$), with loadings

Figure 2. Bayesian Reliability Plot



Note. A: Posterior distribution of the omega reliability coefficient; B: If item dropped plot; C: Posterior Predictive Check for Omega; D: Trace Plot.

Figure 3. Relational model between well-being (SWB) and depression.



from PHQ and SWB items indicating their respective contributions to each construct. Error terms for PHQ-8 items 2 (“feeling down, depressed, or hopeless”) and 6 (“feeling bad about yourself”) were correlated based on modification indices suggesting improved fit, reflecting their conceptual overlap in negative self-evaluation. This analysis shows how measures of depression and well-being are interrelated in line with the theoretical framework presented.

Discussion

Understanding and measuring how children feel about their lives is crucial, and this is where the Subjective Well-Being Scale (SWB-3) plays an important role. In fact, this scale focuses on assessing how young children perceive their happiness (Lyubomirsky & Lepper, 1999), capturing essential details of children’s emotional world, such as their overall life satisfaction (Diener et al., 2018). This interest is fundamental because subjective well-being in childhood is influenced by factors such as family, friends, school, and physical health, highlighting the importance and complexity of measuring this construct accurately (Cabieses et al., 2020; Casas & González-Carrasco, 2019). Motivated by the innovative aims of our investigation, we adopted a Bayesian framework to ensure our data remained precise and dependable (Merkle & Rosseel, 2018; Ribeiro et al., 2021). We chose this approach for its exceptional flexibility and modeling accuracy, effectively sidestepping the constraints of frequentist methods, an advantage that proves vital when working with small samples or under challenging data-collection conditions (Ribeiro et al., 2021).

Drawing on prior evidence of the SWB-3’s effectiveness in capturing well-being (Ventura-León et al., 2023), we adopted an illustrated format. By portraying familiar daily scenes and behaviors, images encourage more consistent responses and help children overcome language barriers while clarifying

abstract concepts (Ernst et al., 1994; Maćkiewicz & Ciecuch, 2016; Valla et al., 2000). Given the limited availability of validated, child-friendly measures of subjective well-being, developing a freely accessible pictorial version of the SWB-3 has become essential for mental health professionals, educators, and researchers. In our sample, this illustrated SWB-3 upheld a clear unidimensional structure, closely mirroring findings from previous validations across diverse populations (Su et al., 2016; Ventura-León et al., 2023).

Our descriptive analysis revealed a clear bias toward the highest agreement option (“Strongly Agree”), especially for item 1 (“Overall, I consider myself a very happy child”) and item 3 (“Overall, I am very happy and enjoy life”). This pattern likely reflects children’s innate optimism or the developmental stage in which they naturally view their surroundings through a positive lens. Cultural and family influences (where happiness and well-being are regularly celebrated) may further reinforce these upbeat self-evaluations (Cabieses et al., 2020; Casas & González-Carrasco, 2019).

To examine the internal structure of the scale, we conducted a Bayesian Confirmatory Factor Analysis (BCFA). The results upheld a single-factor model, with the Posterior Predictive P-value hovering around 0.50, an indicator of solid model fit. Furthermore, the BRMSEA and BCFA are within acceptable limits. Additionally, it was observed that the BF was significantly higher for the proposed one-factor model compared to a null model. This model reflects that subjective well-being can be assessed from a single and global perspective, like previous studies conducted in other populations (Su et al., 2016; Ventura-León et al., 2023). Furthermore, the factor loadings were between .80 and .93, which can be considered high, and the 95% credibility intervals were in the same category.

From an applied perspective, it is also informative to examine whether any of the three items contributes uniquely to the SWB-3 construct. In our data, Item 1 (“Overall, I consider myself a very happy child”) showed the highest loading ($\lambda = .93$), suggesting it may be the most representative single indicator of children’s subjective well-being. This makes sense given that subjective well-being involves both a cognitive evaluation of life satisfaction and an affective, emotional component (Diener et al., 1997; Dagger & Sweeney, 2006), which Item 1 captures in a global “happiness” judgment (Diener, 1984). Items 2 (“I feel happy most of the time”) and 3 (“I enjoy my life”) also load strongly ($\lambda = .88$ and $\lambda = .85$, respectively), reflecting children’s innate optimism (Sabato & Kogut, 2019) and the advantage of pictorial formats in overcoming language barriers to clarify emotional concepts (Ernst et al., 1994; Valla et al., 2000). While all three items meaningfully capture the construct, Item 1’s particularly high loading underscores its utility as a brief screener when resources are limited.

The Peruvian version of the SWB-3 demonstrated good reliability ($\omega = .86$) obtained through the median of the posterior distribution and supported by credibility intervals (.845, .878). This finding is particularly relevant because previous studies that analyzed the SWB-3 within the framework of classical test theory demonstrated good reliability through alpha coefficient and composite reliability (Lyubomirsky & Lepper, 1999; Su et al., 2016), which is like the omega coefficient. However, in this study, a Bayesian version of the omega coefficient was used (Pfadt et al., 2023), which, although lacking simulation studies,

shows promise by using the mean of the posterior distribution to estimate the precision of SWB-3. These results were supported by the trace plot graph, which indicated good convergence.

One of the findings of the study is that SWB-3 showed a relationship with depression, in the direction and strength indicated by previous studies. Indeed, our findings are like those obtained in China (Ouyang et al., 2021), and although there are studies suggesting that the relationship could be even stronger (Patias et al., 2017; Pinto et al., 2018), this denotes their link. In our literature review, a lower correlation between the variables was found, but it still can be considered moderate (Park et al., 2023). These results emphasize the predictive power of SWB-3 and reinforce the need to address these disorders to improve individual mental health (Whitehead et al., 2019). Therefore, measures of depression and subjective well-being are interconnected and should be carefully considered in research and clinical practice with minors.

This study provides valuable insights into several key areas. In recent years, research on children's subjective well-being has gained traction, yet investigations in Peru are still few. By centering our work on Peruvian schoolchildren, we deepen the theoretical framework, revealing how well-being influences developmental pathways in this specific cultural setting (Cabieses et al., 2020; Casas & González-Carrasco, 2019). From a practical perspective, enriching the SWB-3 with illustrations marks a key innovation: visual scenarios help children bypass language and cognitive barriers, making their responses more intuitive and reliable (Ernst et al., 1994; Valla et al., 2000). Evidence shows that such pictorial tools can sharpen measurement precision for complex constructs like well-being (Diener et al., 1997; Maćkiewicz & Ciecuch, 2016). These enhancements have real-world implications: they can inform public policy, shape educational practices, and refine clinical assessments in Peru. Ultimately, a proactive focus on childhood subjective well-being may foster emotional regulation, empathy, resilience and in turn support stronger academic performance and healthier social relationships (Chai et al., 2019; Katsantonis et al., 2023; Sabato & Kogut, 2019; Schutz et al., 2022).

In the study of SWB-3 validity in the Peruvian child population, there were some methodological limitations. First, the use of non-probabilistic sampling, a choice conditioned by budgetary limitations and the challenges of accessing educational institutions in the post-pandemic scenario. Although this methodology was selected for practical feasibility, it is necessary to acknowledge that this limits the generalization of the results. In future studies, it would be ideal to use other forms of sampling, such as random sampling. Second, although we demonstrated convergent validity through a negative correlation with PHQ-8, we did not include a dedicated well-being instrument (e.g., life satisfaction or positive affect scales) to establish true concurrent validity, as contemporary models view well-being as more than merely the absence of distress. Finally, given the known influence of factors such as dysfunctional family environments, exposure to violence or trauma, and physical or mental health complications on children's subjective well-being, future research should explore these variables to deepen our understanding of SWB-3's predictive scope (Pickett et al., 2022; Sarriera et al., 2021).

The research confirms the effectiveness of SWB-3 for children in Peru, highlighting how its use of illustrations and the

Bayesian approach significantly contribute to accurately measuring child well-being. There is a clear inclination toward positive responses, and the simple structure of SWB-3 is verified, which is in line with previous studies and underscores its value in both educational and clinical settings. While we acknowledge limitations, such as the reliance on non-probabilistic sampling (Maxwell, 2012) and the absence of depression or anxiety measures. These very constraints illuminate clear avenues for future research. By delivering a rigorously validated, culturally adapted tool for assessing children's subjective well-being, this work lays a crucial foundation for shaping policies and practices that genuinely promote young people's emotional and social development.

Ensuring we recognize and address Peruvian children's subjective well-being is vital for nurturing their emotional and psychological growth. In our investigation, we present a culturally tuned version of the Subjective Well-Being Scale (SWB-3) for children in Peru, leveraging a Bayesian analytical framework to maximize both precision and reliability. Moreover, by embedding visual cues, such as illustrated daily scenarios, the scale not only captivates young respondents but also more accurately reflects their emotional states and overall life satisfaction. Notably, our results reveal a pronounced lean toward high-scoring responses, which suggests an innate optimism among participants. Our Bayesian confirmatory factor analysis further confirmed the SWB-3's strong reliability and clear one-dimensional structure, underlining its suitability for this age group. Crucially, the scale demonstrated promise in flagging early signs of depressive symptoms, thereby enabling timely, targeted interventions. By blending intuitive visual supports with a rigorous Bayesian approach, this research significantly enriches the methodological toolkit for understanding and enhancing children's well-being in Peru, laying a solid foundation for evidence-based policy and effective mental health practices.

Conflict of interests

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Appendix

SWB-3. Í Instructions: Mark with a cross (X) the face that best represents how you feel:

1. En general me considero una niño(a) muy feliz.
In general, I consider myself a very happy child.



2. En comparación con la mayoría de las niños(as) de mi edad, me considero él/la más feliz.
Compared to most children my age, I consider myself the happiest.



3. En general soy muy feliz y disfruto de la vida
In general, I am very happy and enjoy life.



Note. The English version of the items is presented in brackets and should be reviewed in the future, as the validation was carried out with the Spanish items.