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The parabolic path of teacher well-being and student learning achievement in Peru

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We investigate the connection between teacher subjective well-being (TSWB) and the learning achievement of public-school students in Peru. Leveraging data from the National Teacher Survey and the Census Student Assessment, we identify that TSWB consists of three invariant dimensions: satisfaction with school relationships, living conditions, and working conditions. Our regression models suggest that the relationship between school-level TSWB and mathematics and reading scores follows an inverted U-shape, consistent with the presence of the "too-much-of-a-good-thing" effect. This suggests diminishing returns, with an optimal threshold beyond which further TSWB increases are associated with lower pupil scores.

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Introduction

Teachers have a critical role in the quality of educational systems (Hanushek and Rivkin, 2006). Their influence is undeniable in the classroom, but also extends beyond it, impacting pupils' outcomes even into adulthood (Chetty et al., 2014). Despite their pivotal role in society, several countries report serious concerns about recruiting and retaining good quality teachers (OECD, 2005), principally due to teacher shortages and deteriorating working conditions (Flores, 2023; See et al., 2020).

Behavioral science research offers potential solutions to these challenges. Enhancing subjective well-being may not only attract and retain talent but also improve job performance and productivity (DiMaria et al., 2020). Indeed, positive experiences and emotions foster motivation, creativity, and workplace interactions (Tenney et al., 2016). However, the evidence specifically related to the teaching profession remains inconclusive. It is unclear whether higher levels of teacher subjective well-being, or related constructs, lead to improvements in student achievement.

The complexity of this issue has become increasingly evident in recent literature. For instance, Hoque et al.'s (2023) review demonstrates that teachers' levels of job satisfaction, whether low or high, can coexist with both low and high levels of student achievement, depending on the country. The meta-analysis performed by Maricuțoiu et al. (2023) reveals stable, weak correlations between teacher's subjective well-being and student achievement. Similarly, Wartenberg et al. (2023) in their meta-analysis and systematic review, report a small to moderate relationship between teachers' job satisfaction and student achievement, suggesting that this may be due to achievement being the most distal outcome in the causal chain under consideration.

This work examines the relationship between teachers' subjective well-being and student learning outcomes in Peru, offering an alternative explanation for the mixed findings in recent literature. We present new evidence suggesting that the association between teacher subjective well-being and student achievement is characterized by an inverted U-shaped pattern. This relationship would be driven by the "too-much-of-a-good-thing" effect (TMGT effect) (Pierce and Aguinis, 2013), which is consistent with the fact that high levels of happiness do not always have positive effects on individuals (Britton, 2019; Gruber et al., 2011). Indeed, high levels of satisfaction can reduce motivation to seek change, pursue new goals, and engage in self-improvement, as individuals tend to prioritize maintaining their current state of happiness (Grant and Schwartz, 2011; Oishi et al., 2007).

Examining the Peruvian case within this research question provides valuable insights for testing previous findings in a developing context. Peru's notable challenges, such as disparities in educational resources, infrastructure, and socioeconomic inequalities, significantly impact both TSWB and student achievement. These characteristics are shared by many developing countries worldwide, creating a unique context for exploring the relationship between TSWB and student outcomes. This analysis may reveal patterns that diverge from the predominantly developed-country-focused research literature.

This study provides four advancements to current literature. First, it delineates the subjective well-being structure of public sector teachers using a nation-wide representative sample. Studies in this topic have usually analyzed non-representative data, based on small samples, often selected through convenience and purposive sampling (Hascher and Waber, 2021). Second, instead of narrowly focusing on one aspect of well-being, such as the conventional job satisfaction (Hoque et al., 2023; Zieger et al., 2019), we provide a comprehensive examination of different TSWB dimensions. Our data set contains questions about teachers' satisfaction with different aspects of their life and work, providing

a better picture of their well-being. Third, it pioneers exploring how different aspects of TSWB relate to students' academic outcomes in developing contexts, expanding beyond the prevalent focus of existing literature on developed countries. Lastly, this study employs a flexible specification to capture potential non-linearities in the TSWB–student learning relationship, recognizing that patterns may vary across well-being levels and offering a new perspective on their association.

To tackle our objective accordingly, the empirical strategy relies on the National Teacher Survey (ENDO) 2016 and 2018, carried out by the Peruvian Ministry of Education. Our study leverages the untapped potential of this resource, which, despite its richness and distinctiveness within the context of developing countries, has been largely overlooked and underutilized in academic research. For our purposes, ENDO provides mainly the school average TSWB score. We match these data with school test scores in mathematics and reading, obtained from the Census Student Assessments. We complement this information with data from the School Census to obtain school characteristics, and the Poverty Map for monetary poverty rates at the district level.

Our findings unveil a portrait of TSWB, comprising three pivotal dimensions: satisfaction with school relationships, living conditions, and working conditions. The multigroup confirmatory factor analysis reveals the robustness of this structure over time (2016–2018), across educational levels, geographical locations, and rural settings. Furthermore, the study illuminates noteworthy disparities in TSWB levels between primary and secondary education, among teachers motivated by vocation, and those contemplating a change in their school district. Interestingly, TSWB exhibits an inverted U-shaped relationship with students' learning achievement, suggesting an optimal threshold beyond which higher TSWB correlates with negative returns. Finally, among the TSWB dimensions, school relationships emerge as the most influential in shaping TSWB dynamics.

The rest of the paper is organized as follows. First, we present the related literature and institutional setting (section "Background"). Then, we describe the data (section "Data") and the empirical strategy (section "Methodology"), followed by a presentation of the main results (section "Results and Discussion"). The conclusions and policy implications close the document (section "Conclusions").

Background

Related literature. While research on teacher well-being and student learning in Latin America, particularly Peru, remains scarce, international studies provide valuable insights into this relationship. This section incorporates findings from various contexts to build a broader theoretical framework while acknowledging potential differences in educational systems and socio-economic conditions.

Subjective well-being comprises the individuals' appraisals about their whole life or certain aspects of their experience such as job, marriage, etc. (Diener et al., 2018). Extensive literature suggests that subjective well-being has an important relationship with the performance of workers and organizations (Oswald et al., 2015; Salgado and Moscoso, 2022). As workers have positive evaluations about their job and life experiences, they increase their self-regulation, motivation, creativity, positive relationships, among other aspects, which in turn contribute to the performance of organizations (Tenney et al., 2016). Recently, the interest to understand teachers' subjective well-being and its relationship to students' learning have increased (Hoque et al., 2023; Maricuțoiu et al., 2023; Wartenberg et al., 2023). Examining

these academic concerns offers opportunities to enhance teacher policies and students' educational experiences.

Current literature on the structure of TSWB has mainly focused on job-related aspects. For instance, the TSWB scale developed by Renshaw et al. (2015) assesses specific psychological features of teachers within their workplace. In the same vein, other scholars have investigated the invariance of job satisfaction of teachers across countries that participated in the Teaching and Learning International Survey (Katsantonis, 2020; Zakariya et al., 2020; Zieger et al., 2019). These studies highlighted the differences between countries in this job attitude. Nevertheless, the well-being of workers is also significantly influenced by their satisfaction with life and its various domains (Erdogan et al., 2012). This holds true for teachers as well (Demirel, 2014). Thus, it is critical to consider these aspects in TSWB measures. We propose a holistic approach to study TSWB, defining it as the teachers' judgments about their living and working experiences. Fitch et al. (2017) advanced in this line with a non-representative sample of 183 Mexican teachers. However, a literature gap persists in the testing of such measures with representative samples in developing contexts.

Studies on the relationship between TSWB and student learning present mixed results. Maricuțoiu et al. (2023) performed a meta-analysis of 26 studies finding that eudaimonic well-being is weakly related to students' learning achievements ($r = 0.065$). Wartenberg et al. (2023) find similar results in their meta-analysis of 105 studies on teacher job satisfaction and students' achievements ($r = 0.10$). A third meta-analysis reveals varied associations between teacher job satisfaction and student achievement, including high satisfaction with low achievement, and vice versa (Hoque et al., 2023). We argue that the "too-much-of-a-good-thing" effect (TMGT effect) can explain this puzzle of mixed results found in the literature. Indeed, the TMGT effect states that something positive, when presented in excess, can have the opposite result than expected (Pierce and Aguinis, 2013). This concept is somewhat related to the "dark side" of happiness (Gruber et al., 2011).

In this context, the present research aims to explore TSWB focusing on its structural dimensions and its link with student learning achievement. Drawing on the literature cited above and the ENDO survey, we anticipate uncovering three TSWB dimensions. First, satisfaction with living conditions, including health, self-esteem, and family concerns (Cumming, 2017; E. S. Lee and Shin, 2017; Milfont et al., 2008; Yamamoto, 2017; Yamamoto et al., 2008, 2022). Second, school relationships, encompassing interactions with colleagues, superiors, students, and parents (Hascher and Waber, 2021). Third, working conditions, encompassing factors such as teachers' salaries, which have been related to their well-being (Song et al., 2020) and it is a critical concern in Peruvian educational policy (Vargas and Cuenca, 2018). Finally, we do not expect a linear relationship between TSWB and student learning achievement due to the TMGT effect.

Institutional setting. Peru's basic public education system serves over 6 million students across three levels: preschool (ages 3–5), primary (ages 6–11), and secondary (ages 12–16). School attendance rates are high, with ~99% of primary-age children enrolled and ~90% attending pre-primary and secondary levels (INEI, 2024). Despite significant improvements in coverage, structural challenges persist, particularly in terms of inequality (Rentería, 2023a). Educational quality varies considerably between urban and rural areas (Arteaga and Glewwe, 2019; Guadalupe, 2024), with remote regions facing severe infrastructure deficiencies (Guadalupe et al., 2017). Public investment in education remains low at 3.8% of GDP. At the same time, the expansion of privatization presents challenges, particularly the poor quality of low-cost private schools (Minedu, 2018; Rentería, 2023b).

Peru's public education system employs nearly 400,000 teachers. The 2012 Teacher Reform Law introduced a merit-based career structure with eight progression levels. However, major challenges persist, including low salaries—among the lowest in Latin America even after recent increases (Mizala and Ñopo, 2016)—and stark disparities in working conditions between urban and rural schools (Castro and Guadalupe, 2021). These factors shape the teaching profession and influence teacher well-being.

International comparisons help contextualize these challenges. OECD countries typically invest over 5% of their GDP in education and provide more structured teacher support systems (OECD, 2024). These differences in investment, working conditions, and professional development contribute to gaps in teacher well-being and student outcomes between Peru and higher-income countries. Reflecting these disparities, PISA assessments consistently show that students in OECD countries outperform their Peruvian counterparts in mathematics, reading, and science (Minedu, 2022).

While this study focuses exclusively on public schools in Peru, its findings contribute to broader discussions on teacher well-being in developing countries with similar structural constraints. Understanding these challenges is essential for designing policies that support teachers and improve educational outcomes.

Data

This study uses pooled data from the 2016 and 2018 editions of the National Teacher Survey (ENDO), conducted by the Peruvian Ministry of Education.[1] ENDO offers national data on regular basic education teachers across both public and private sectors. The ENDO survey follows a probabilistic, stratified, two-stage sampling design, conducted independently within each of the country's 25 departments (first-level administrative divisions). The stratification criteria include department, educational level (initial, primary, secondary), type of management (public, private), and geographic area (urban, rural). In the first stage, educational institutions were selected using systematic sampling with probability proportional to size. In the second stage, teachers were selected systematically with a random start, based on lists obtained during fieldwork. The 2016 sample included roughly 9800 teachers from 3000 schools, while 2018 encompassed 15,000 teachers from 4500 schools. We restrict the analysis to public sector primary and secondary schools.[2]

For the purposes of this paper, ENDO provided mainly the questions dealing with teachers' subjective well-being. These questions are of the form: "Taking all things together, would you say you are…? (i) Not at all satisfied, (ii) A little satisfied, (iii) Satisfied, (iv) Very much satisfied". Table 1 shows the dimensions included in ENDO's questionnaire.[3]

The main analysis of this paper builds on aggregated data at the school level. However, to obtain school TSWB measures we must first work at the teacher level. The sample for obtaining TSWB measures at the school level was made up of 12,661 teachers, almost equally distributed between primary and secondary school levels (Supplementary Table A1). Likewise, the teachers working in urban schools tended to be older and to have permanent positions. These patterns are similar to those shown by other authors (Díaz and Ñopo, 2016; Guadalupe et al., 2017).

Our sample of teachers is distributed among 3719 clusters (school-year), as shown in Supplementary Table A2.[4] In the majority of clusters (almost 6 out of 10), between one and three teachers were surveyed. As stated above, the objective was to work

at the school level, since we had no identifier to match students' test scores to particular teachers, only to schools. In this sense, the characteristics of the sample of schools are presented in Supplementary Table A3.

The second database is the Census Student Assessment (ECE), which is a national standardized test administered by the Ministry of Education. Depending on the year, the ECE is administered to second or fourth-grade primary students, and also to second-grade secondary students. Although it has evolved to greater diversity of subjects in secondary education, here, for the sake of comparability, we restricted the analysis to the results of mathematics and reading tests. Likewise, we considered only the population in regular basic education in 2016 and 2018.

Using ECE, we calculated the pupils' mean scores in mathematics and reading tests for each school-year. Then we transformed them into z-scores (at the school level) and assigned these scores to each of the schools surveyed by ENDO. Finally, we used the School Census 2016 and 2018 (Ministry of Education) to obtain characteristics at the school level (numbers of pupils and teachers, geographical location, among others), as well as the poverty maps for 2013 and 2018 (National Bureau of Statistics) to assign to each school the average poverty rate of its district in monetary terms.

Table 1 National Teacher Survey: Items related to subjective-well being.

Taking all things together, would you say you are:
not at all satisfied, a little satisfied, satisfied, or
very much satisfied with...?

1	Your life[a]
2	Your health status
3	Your job[a]
4	The education that you can provide to your children
5	Your future retirement conditions
6	Your self-esteem
7	Society's recognition towards your job as a teacher[b]
8	Your relationship with your family
9	Your recreational activities
10	Your pedagogical activity[b]
11	Your students' achievement and your relationship with them[b]
12	The Ministry of Education's recognition of teachers
13	Your relationships with colleagues
14	Your relationship with the Principal
15	Your relationships with students' parents
16	Your school's location[b]
17	Your salary
18	Your relationships with the community

National Teacher Survey 2016 and 2018.
[a]Used for external validation only.
[b]Removed according to multi-group confirmatory factor analysis.

Methodology

To obtain a measure of TSWB, we proceed as follows after splitting the sample of teachers surveyed by ENDO into two random subsamples. First, we performed an Exploratory Factor Analysis (EFA) with subsample 1, as a preliminary step to observing if the proposed latent variables emerged among ENDO's items (Goretzko et al., 2021).[5] Second, to test our theoretical three-dimension solution, we performed a Confirmatory Factor Analysis (CFA) with subsample 2. We employed standard criteria for the fit indices assessing our CFA models, namely CFI > 0.900, RMSEA < 0.080, and SRMR < 0.080 (Hooper et al., 2008; Hu and Bentler, 1999). Third, to ensure that our factor solution has the same configuration, meaning, and is comparable across groups (by year, teaching level, rurality, and geographical region), we performed a Multi-Group Confirmatory Factor Analysis (MGCFA). We took a bottom-up approach (Steenkamp and Baumgartner, 1998), testing progressively configural (same loading pattern), metric (same factor loadings), and scalar (same intercepts) levels of invariance (Nießen et al., 2020). The same fit indices used for CFA were also used to test configural invariance. For metric and scalar invariance, we followed Chen (2007) recommendations to consider that the model has not been undermined: $\Delta CFI \leq -0.010$ and $\Delta RMSEA \geq 0.015$ or $\Delta SRMR \geq 0.010$. Finally, we tested the external validity of these dimensions by analyzing the relationship between the scores obtained in each of these latent variables (based on CFA) with other indicators also present in ENDO, using the whole sample (Table 2). This complied with two conditions: (i) being also related to subjective well-being, and (ii) not having been included in the previous steps. This kind of test is a common practice for validating psychometric constructs (Renshaw et al., 2015).

Next, to assess the association between teacher subjective well-being and student academic performance, we performed an OLS regression of the following form, at the school level:

$$Y_s = \beta_0 + \beta_1 TSWB_{fs} + \beta_2 TSWB_{fs}^2 + A_s\gamma + B_d\lambda + \delta_t + \delta_g + \varepsilon_s$$

$$(1)$$

For each school s: Y_s is the average students' test z-score in school s, $TSWB_{fs}$ is the school s's score in the teacher subjective well-being factor f. We incorporate control variables to mitigate potential omitted variable bias and isolate the partial correlation between TSWB and student learning from confounding elements at the school and district levels. The vector A_s includes the following school-level characteristics that can influence both the teaching environment and student outcomes: number of teachers, female teacher ratio, fixed-term teacher ratio, student-teacher ratio, and number of educational areas. The number of teachers reflects school size, while the female teacher ratio may capture gender dynamics in the teaching environment. The fixed-term teacher ratio accounts for employment stability, influencing staff turnover. The student-teacher ratio serves as a proxy for class size

Table 2 Selected items from ENDO for the external validity test.

Topic	Question	Response options
Children as teachers	If you have or would have children, would you or would you not like one of them to be a school teacher?	1. Yes, I would like to (recoded = 1) 2. I would not care (recoded = 0) 3. I would not like (recoded = 0)
Choosing teaching again	If you could go back, would you choose to be a teacher again?	1. Yes (recoded = 1) 2. No (recoded = 0)
Happiness with the school job	Are you happy with your current job at this school?	1. Yes (recoded = 1) 2. No (recoded = 0)
Life satisfaction	Item 1 - Table 1	Same scale as the other TSWB items.
Job satisfaction	Item 3 - Table 1	

Table 3 Results of invariance analyses at configural, metric, and scalar level by geographic region, year, teaching level, and rurality.

	Chi2	df	RMSEA	CFI	SRMR
By geographic region					
Configural	2769.61	328	0.069	0.913	0.043
Metric	2907.98	384	0.064	0.910	0.047
Scalar	3156.22	440	0.062	0.903	0.047
By year					
Configural	2372.91	82	0.066	0.919	0.039
Metric	2457.67	90	0.064	0.916	0.040
Scalar	2690.52	98	0.065	0.908	0.041
By teaching level					
Configural	2414.64	82	0.067	0.918	0.039
Metric	2450.39	90	0.064	0.917	0.040
Scalar	2592.15	98	0.063	0.912	0.040
By rurality					
Configural	2435.01	82	0.067	0.917	0.041
Metric	2476.71	90	0.065	0.916	0.042
Scalar	2648.24	101	0.063	0.910	0.042

Chi2 chi-square, *df* degrees of freedom, *RMSEA* Root Mean Square Error, *CFI* comparative fit index, *SRMR* standardized root mean square residual.

and instructional quality. Lastly, the number of educational areas, representing the number of rooms, reflects the school's infrastructure capacity. These variables help control for school-level heterogeneity. The vector B_d includes district-level characteristics that may shape both school resources and educational conditions: poverty rate, rural status, and geographic domain. The poverty rate captures the economic context, which can influence school funding, student preparedness, and access to educational resources. The rural status distinguishes schools in less populated areas, often associated with limited infrastructure and teacher availability. The geographic domain accounts for broader regional differences that may affect policy implementation and educational opportunities. These variables help control for district-level heterogeneity in the analysis. The terms δ_t and δ_g capture survey year and student assessment grade fixed-effects. Finally, ε_s is the usual error term. The coefficients of interest are β_1 and β_2. A positive value for the former and a negative value for the latter would provide empirical support for a nonlinear relationship. To confirm this, we formally test for an inverted U-shaped relationship using the test proposed by Lind and Mehlum (2010). This test verifies whether the estimated relationship is concave within the observed range of the independent variable by assessing whether the slope of the regression function is significantly positive at lower values and significantly negative at higher values. Following their approach, we estimate a quadratic specification and compute confidence intervals for the extreme point to ensure that it falls within the range of the data. In our context, this method provides a rigorous statistical test for the TMGT hypothesis.

Results and discussion
The structure of teachers' subjective well-being. The results from EFA support the initial hypothesis that teachers' subjective well-being is configured by three factors of satisfaction with acceptable internal consistency (Supplementary Table B1): *satisfaction with school relationships* (hereafter, F1), *satisfaction with living conditions* (hereafter, F2), and *satisfaction with working conditions* (hereafter, F3). Using this solution, the results from CFA align with those of EFA, suggesting that the structure of three TSWB dimensions is acceptable ($\chi2 = 1964.31/df = 99$, CFI = 0.917, RMSEA = 0.055, SRMR = 0.038).

Next, the MGCFA compared our factor solution across the eight geographic regions considered in the survey: the North, Central and South Coast; the North, Central and South Andes; the Amazonian Rainforest, and the Capital City - Lima. Configural invariance did not reach an acceptable CFI ($\chi2 = 4849.40/df = 696$, CFI = 0.899, RMSEA = 0.062. SRMR = 0.046). We also did not obtain good fit indicators for the metric ($\chi2 = 5055.20/df = 780$, CFI = 0.897, RMSEA = 0.059. SRMR = 0.050) and scalar ($\chi2 = 5478.35/df = 864$, CFI = 0.889, RMSEA = 0.058. SRMR = 0.050) level of invariance with that configuration. Therefore, we run factor analyses on each of these geographical groups to identify problematic items (Schneider, 2017). The factor loadings for social recognition, student achievement, school location, and pedagogical activity exhibited significant disparities between the groups studied. Thus, we proceed to run the MGCFA without these items, obtaining acceptable fit indices for configural, metric, and scalar invariance across the eight geographic regions, the two survey years (2016 and 2018), the teaching level (primary and secondary), and rural (vs. urban) setting (cf. Table 3).

Finally, we run a CFA with this last model with the whole sample, getting good fit indices ($\chi2 = 2369.25/df = 41$, CFI = 0.918, RMSEA = 0.067. SRMR = 0.038).

In the light of these results, the subjective well-being of Peruvian teachers may be summarized under three broad headings (dimensions), as depicted in Fig. 1. The results confirm that, in the case of teachers, the relationships with the school community, with students' parents, and with students themselves are relevant to their subjective well-being, in addition to the predictable relationships with peers and superiors (factor 1). In the case of Peruvian teachers, who are on average 45 years old and have generally formed their own families, aspects such as children's education or family relationships are part of the evaluation of their satisfaction with life (factor 2). This suggests a different approach to understanding subjective well-being, because most of these measures traditionally have individualistic indicators that do not necessarily consider family concerns (Krys et al., 2021). Finally, working conditions such as salary or retirement are important aspects of a teacher's well-being (factor 3). Moreover, these dimensions are closely interrelated.

Having confirmed the structural form of TSWB, we can predict, for each teacher, her score for each TSWB factor and study their main features. Larger values indicate higher levels of subjective well-being in the corresponding factor. By construction, they all have a mean virtually equal to zero. However, the TSWB factor 3 has the lowest variance (sd = 0.22), while factor 1 has the highest (sd = 0.31).

The results from external validation show that the three identified dimensions are associated with other indicators of teachers' subjective well-being. Teachers satisfied with their school relationships, living conditions, and working conditions are more inclined to express support for their children pursuing a teaching career, exhibit a higher likelihood of choosing the teaching profession again, experience greater happiness in their school job, and report overall satisfaction with life and job (Table 4). The associations between TSWB dimensions and satisfaction with life and job exhibit considerable strength, implying a coherent alignment between TSWB dimensions and these job-related attitudes. The TSWB dimensions display weak or moderate correlations (Gignac and Szodorai, 2016) with the remaining measures in Table 4, indicating, however, that our well-being dimensions are also associated with affective or behavioral outcomes. Consequently, we can assert that the three dimensions serve as valid measures of TSWB.

In this context, we explore the associations between TSWB factor levels and various teacher and school characteristics, as well
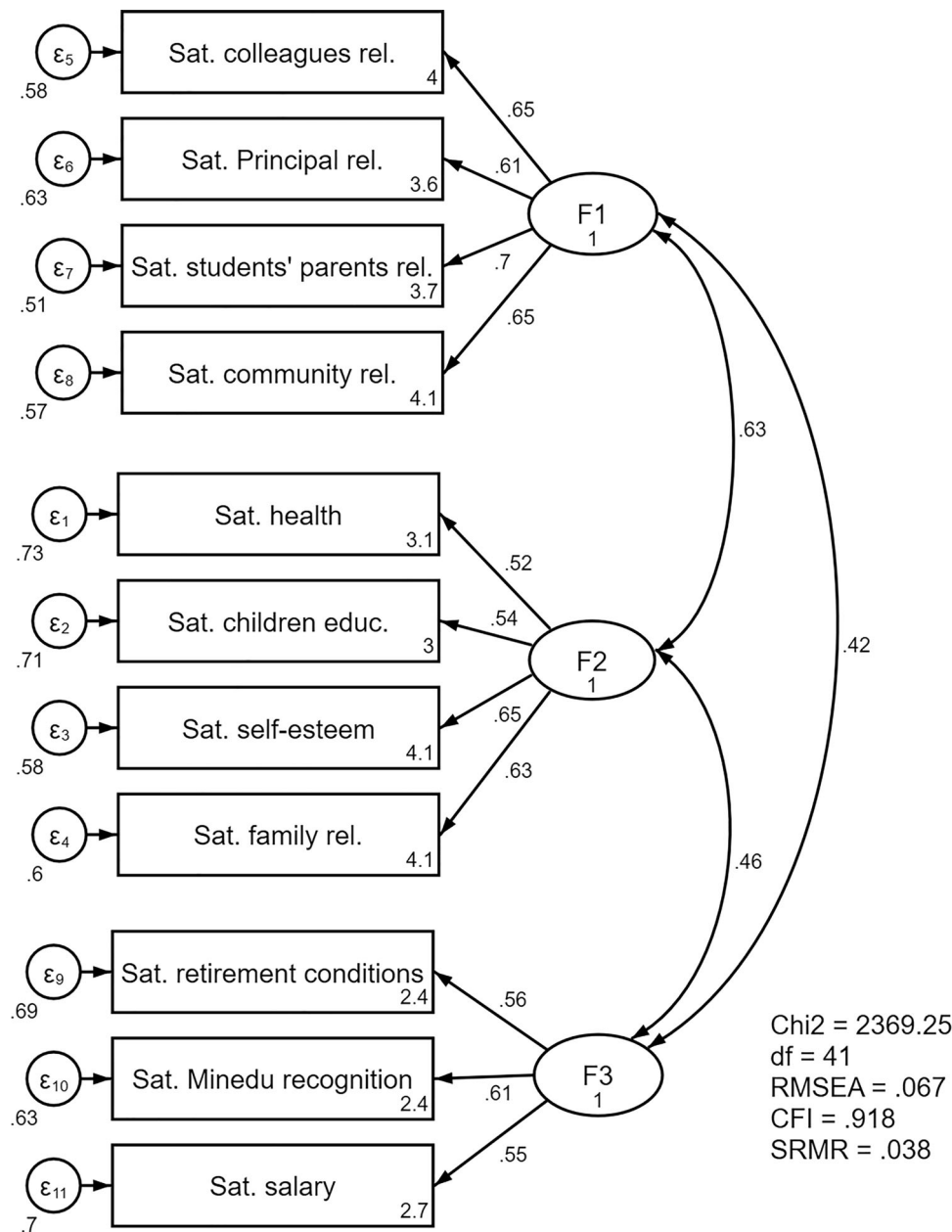
Fig. 1 Teacher subjective well-being: Confirmatory Factor Analysis path diagram. This confirmatory factor analysis model depicts three latent constructs (represented by ovals) operationalized through multiple observed satisfaction indicators (rectangular boxes): F1 = "Satisfaction with school relationships", F2 = "Satisfaction with living conditions", and F3 = "Satisfaction with working conditions". Double-headed arrows indicate correlational relationships between latent variables, while unidirectional arrows represent standardized factor loadings. Circles denote measurement error terms associated with each observed variable. Goodness-of-fit indices are reported: Chi-square test (Chi2), Degrees of Freedom (df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR).

as teachers' perceptions, by estimating linear regression models (cf. Supplementary Table C1). Figure 2 illustrates the coefficients for factor 1.[6] Descriptive graphs of key variables are provided in Supplementary Figs. E1–E4.

Among the variables under consideration, those in the model related to teachers' perceptions are particularly relevant. For example, more satisfaction with household income is associated with a higher score in TSWB factor 1. In the same way, those teachers who chose their profession based on vocation (rather than pragmatic reasons) show higher TSWB scores. With respect to school characteristics, dissatisfaction with the location of the school is associated with lower TSWB levels. Likewise, teachers in secondary education exhibit lower scores in factor 1 compared to

those in primary education. This suggests that primary and secondary levels pose different challenges to teachers, which is consistent, for instance, with evidence from the UK that secondary teachers have lower subjective indicators of well-being than primary teachers (Scanlan and Savill-Smith, 2021).

TSWB and student achievement: The TMGT effect. As a first descriptive approximation, Fig. 3 presents non-parametric conditional expectation functions regarding the relationship between students' learning achievement and the TSWB factors. The curves show an inverted-U shaped pattern, meaning that there is a nonlinear relationship between our variables of interest. Students'

z-scores increase with TSWB, but only up to a threshold beyond which they start to decrease. This kind of relationship is not uncommon when studying subjective well-being or related topics: it is often the case that having only a little or having a great deal of something is not beneficial (Grant and Schwartz, 2011).[7] Speaking more generally, this issue could be related to the meta-theoretical principle called the "too-much-of-a-good-thing" effect (Pierce and Aguinis, 2013), which occurs when "an initially positive relation between an antecedent and a desirable outcome variable turns negative when the underlying ordinarily beneficial antecedent is taken too far, such that the overall relation becomes nonmonotonic" (Busse et al., 2016, p. 131).

Let us now consider the OLS results from Eq. (1). Tables 5 and 6 present the TSWB factors and their squared terms for mathematics and reading tests, respectively, while progressively controlling for the covariates outlined in section 4 (in addition, heterogeneity analyses are reported in Supplementary Tables F1 to F6.).[8] As expected, the coefficient magnitudes change with the inclusion of controls, reflecting TSWB's correlation with school and district characteristics. However, the sign remains consistent in most cases. Incorporating controls helps mitigate omitted variable bias, providing a clearer estimate of its independent association with learning achievement. Focusing on columns (3), (6), and (9), the linear coefficients related to TSWB factors display the expected sign with schools' average scores in both mathematics and reading. That is, the greater the TSWB component, the higher the test score. In contrast, the squared TSWB factors' term displays negative values, suggesting diminishing associations, aligning with the initial descriptive patterns presented in Fig. 3. It is worth noting that the three TSWB factors show statistical significance simultaneously for both the linear and the squared terms, except for factor 3 in reading.

The formal test of the U-shaped pattern is detailed in Supplementary Table D1. The results suggest an inverted U-shaped relationship between the three TSWB factors and academic achievement, with the only exception being factor 1 in reading, which falls just short of statistical significance at the 10% level. The conclusion is based on the verification of a negative second derivative and the extremum point being sufficiently distant from the data boundaries. While the underlying relationship for the latter factor may be convex but monotonic, it remains consistent with the presence of diminishing marginal returns.

Additionally, Table 7 reports the predicted change in student test scores across TSWB deciles. For all three TSWB factors, a substantial improvement is observed as TSWB increases from low to mid levels. However, the marginal gains decrease as TSWB rises, with predicted changes approaching zero or even becoming negative by the 80th or 90th deciles.

Regarding TSWB factor 1, it is plausible to argue that, at moderate levels, having good school relationships means that a teacher maintains harmonious interactions with colleagues, superiors, and other members of the educational staff. These positive relationships may promote a collaborative work environment, where teachers share resources, ideas, and strategies, and mutually support each other in challenges. Such dynamics can contribute to a healthy work atmosphere, enhance job satisfaction, and improve effectiveness (Tran et al., 2018). However, for sufficiently high values of TSWB factor 1, further increases may no longer yield gains in student achievement. Indeed, an excessive focus on maintaining positive work relationships may entail drawbacks (Pillemer and Rothbard, 2018). For instance, a teacher might avoid necessary confrontations or refrain from giving constructive feedback for fear of harming relationships. This aversion to conflict could lead to the perpetuation of ineffective educational practices or failing to address significant issues in the classroom or institution. Ultimately, extreme closeness between colleagues might also hinder the necessary objectivity in certain pedagogical or administrative decisions, where it is essential to maintain a degree of professionalism and distance (Pillemer and Rothbard, 2018).

Similarly, the rationale extends to TSWB factor 2. Previous studies suggest that individuals highly satisfied with their circumstances are less likely to be motivated to pursue changes on them (Oishi et al., 2007). Thus, teachers largely satisfied with their living conditions might potentially face challenges such as complacency, reduced motivation, or a lack of resilience in the face of professional difficulties. Also, they may prioritize personal commitments over their professional responsibilities. Consequently, this could lead to a plateau or decline in their effectiveness as educators, with potential repercussions on student achievement.

Regarding TSWB factor 3, focusing on working conditions and student achievement, we argue that a similar logic operates (Oishi et al., 2007). When teachers face high levels of satisfaction with working conditions, this is not necessarily related to improvements in their performance. However, these results need careful consideration as data does not fit well with the model and more studies are required. Specifically, the bottom panel of Fig. 3 revealed that a quadratic function may not be the optimal choice for capturing the relationship between TSWB factor 3 and student achievement in our dataset, given the strong positive skewness of the distribution. While alternative functions might be more suitable, they often entail a trade-off with increased complexity in interpretation. In essence, the presence of the TMGT effect is also suggestive with factor 3.

In sum, our findings contribute to the literature by highlighting the counterintuitive effect of excessive teacher well-being on student achievement. This aligns with the TMGT effect, where high satisfaction levels may reduce motivation to seek change, pursue new goals, and engage in self-improvement, as individuals prioritize maintaining their current state of happiness (Grant and Schwartz, 2011; Oishi et al., 2007). This diminished drive could translate into less adaptive teaching practices, ultimately affecting student outcomes.

Conclusions

This study first proposed a structure for TSWB based on items from the National Teacher Survey, using a representative sample of public basic education teachers. The structure considered three dimensions that were validated by exploratory, confirmatory, and multi-group factor analyses: (i) school relationships, (ii) living conditions, and (iii) working conditions. Our results expand the current literature by establishing that the well-being of teachers involves not only certain facets of their workplace but also aspects of their personal life (Fitch et al., 2017; Song et al., 2020). Furthermore, our results indicate interconnectedness between the working and living aspects of TSWB. Future studies should move beyond narrow job-focused conceptions and integrate life domain aspects for a comprehensive understanding of TSWB.

Table 4 Correlations between TSWB dimensions and other well-being items.

	Factor 1	Factor 2	Factor 3
Life satisfaction	0.38	0.57	0.30
Job satisfaction	0.42	0.50	0.38
Satisfied with current employment	0.15	0.14	0.11
Would choose teaching profession again	0.13	0.15	0.15
Would like her children to be teachers	0.13	0.14	0.18

All the coefficients are significant at the 0.01 level.
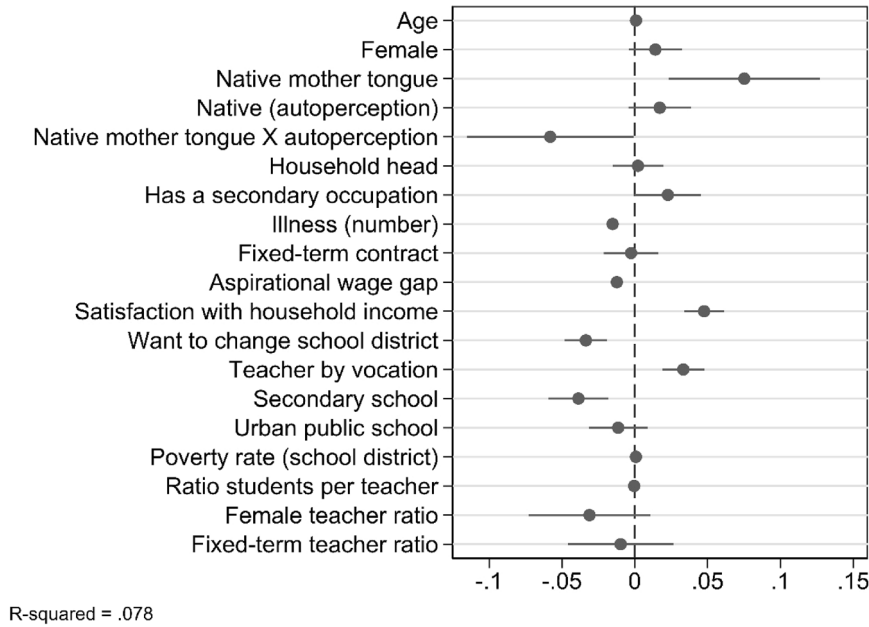
R-squared = .078

Fig. 2 Predictors of TSWB factor 1 at the teacher level. This figure presents OLS estimates with TSWB factor 1 (school relationships) as the dependent variable. Explanatory variables include individual and school characteristics. Bars represent 95% confidence intervals.
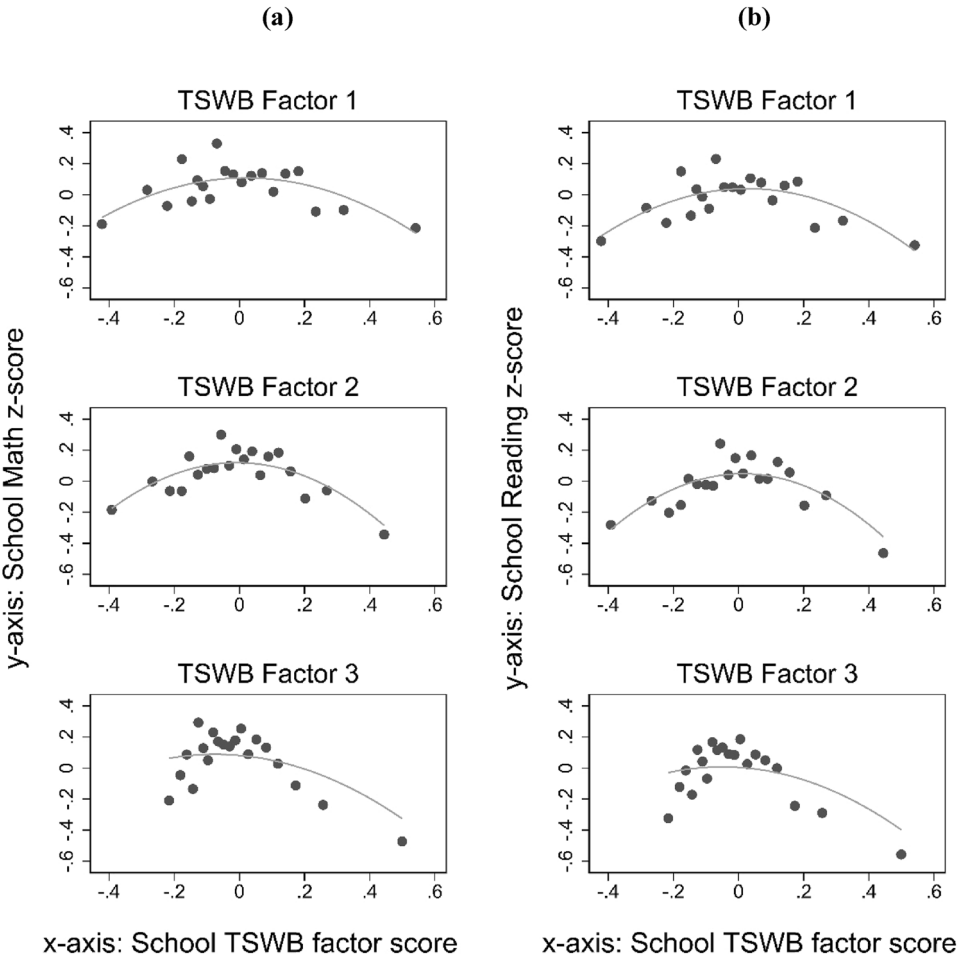

Fig. 3 Students' learning achievement and teachers' subjective well-being factors. This figure shows non-parametric conditional expectation functions at the school level. Panel (**a**) plots mathematics z-scores and panel (**b**) reading z-scores on the y-axis, against school-level teacher subjective well-being (TSWB) factor scores on the x-axis. Each panel includes three plots: Factor 1 "Satisfaction with school relationships" (top), Factor 2 "Satisfaction with living conditions" (middle), and Factor 3 "Satisfaction with working conditions" (bottom).

Table 5 OLS estimates - Dependent variable: School average score in Mathematics.

	Factor 1			Factor 2			Factor 3		
	(1) No Controls	(2) School Controls	(3) All Controls	(4) No Controls	(5) School Controls	(6) All Controls	(7) No Controls	(8) School Controls	(9) All Controls
F1	0.093 (0.089)	0.135 (0.083)	0.303*** (0.079)						
F1-squared	−1.376*** (0.230)	−0.646*** (0.229)	−0.506** (0.217)						
F2				0.025 (0.099)	0.048 (0.088)	0.213** (0.085)			
F2-squared				−2.075*** (0.307)	−0.931*** (0.280)	−0.655** (0.278)			
F3							−0.077 (0.149)	0.006 (0.132)	0.211* (0.122)
F3-squared							−1.397*** (0.355)	−0.648** (0.311)	−0.663** (0.276)
School controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
District controls	No	No	Yes	No	No	Yes	No	No	Yes
N	3,548	3,548	3,548	3,548	3,548	3,548	3,548	3,548	3,548
r2	0.020	0.210	0.320	0.025	0.210	0.318	0.024	0.210	0.317
F	16.54	80.72	85.49	18.76	81.67	85.06	14.43	80.36	85.31

Standard errors in parentheses. All regressions include survey year and student assessment grade fixed-effects. National Teacher Survey and Student Census Assessment, 2016–2018. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 OLS estimates - Dependent variable: School average score in Reading.

	Factor 1			Factor 2			Factor 3		
	(1) No Controls	(2) School Controls	(3) All Controls	(4) No Controls	(5) School Controls	(6) All Controls	(7) No Controls	(8) School Controls	(9) All Controls
F1	0.106 (0.082)	0.124* (0.073)	0.244*** (0.067)						
F1-squared	−1.560*** (0.207)	−0.669*** (0.201)	−0.395** (0.189)						
F2				0.092 (0.091)	0.082 (0.078)	0.186** (0.073)			
F2-squared				−2.251*** (0.274)	−0.900*** (0.247)	−0.463* (0.242)			
F3							−0.070 (0.142)	−0.017 (0.120)	0.147 (0.110)
F3-squared							−1.425*** (0.349)	−0.552* (0.302)	−0.449 (0.283)
School controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
District controls	No	No	Yes	No	No	Yes	No	No	Yes
N	3,548	3,548	3,548	3,548	3,548	3,548	3,548	3,548	3,548
r2	0.022	0.288	0.404	0.026	0.288	0.403	0.022	0.287	0.401
F	17.46	122.07	123.69	19.69	123.45	123.26	10.98	120.33	123.47

Standard errors in parentheses. Note: All regressions include survey year and student assessment grade fixed-effects. Source: National Teacher Survey and Student Census Assessment, 2016–2018. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 Predicted change in student test scores by TSWB decile.

	Mathematics			Reading		
TSWB decile	TSWB Factor 1	TSWB Factor 2	TSWB Factor 3	TSWB Factor 1	TSWB Factor 2	TSWB Factor 3
10	0.553 (0.150)	0.521 (0.165)	0.439 (0.197)	0.440 (0.127)	0.403 (0.139)	0.301 (0.188)
20	0.466 (0.120)	0.432 (0.134)	0.389 (0.179)	0.372 (0.100)	0.340 (0.112)	0.267 (0.169)
30	0.426 (0.107)	0.362 (0.112)	0.350 (0.165)	0.340 (0.089)	0.291 (0.094)	0.241 (0.155)
40	0.384 (0.095)	0.301 (0.097)	0.308 (0.151)	0.308 (0.080)	0.248 (0.082)	0.212 (0.140)
50	0.336 (0.084)	0.239 (0.087)	0.263 (0.137)	0.270 (0.071)	0.204 (0.074)	0.182 (0.125)
60	0.283 (0.077)	0.18 (0.085)	0.218 (0.124)	0.229 (0.066)	0.162 (0.073)	0.151 (0.112)
70	0.214 (0.077)	0.115 (0.090)	0.162 (0.110)	0.175 (0.068)	0.116 (0.080)	0.114 (0.097)
80	0.140 (0.088)	0.034 (0.107)	0.081 (0.097)	0.117 (0.080)	0.059 (0.096)	0.059 (0.085)
90	0.031 (0.120)	−0.088 (0.144)	−0.063 (0.101)	0.032 (0.108)	−0.027 (0.129)	−0.039 (0.095)

Standard errors in parentheses.

Next, based on an analysis at the school level, OLS regressions show that TSWB is associated with students' mathematics and reading scores in an inverted U-shaped pattern, resembling diminishing marginal returns, where the association turns negative beyond a certain threshold.

We argue that this result can be explained by the presence of the "too-much-of-a-good-thing" effect. This phenomenon has been observed in the association between well-being and workplace outcomes (Lam et al., 2014), specifically concerning aspects like personal traits (Zhang et al., 2021) and leadership styles (S. Lee et al., 2017). High satisfaction with living and working conditions may reduce the motivation to seek improvements in these areas. Thus, excessive happiness does not necessarily ensure optimal psychological functioning (Gruber et al., 2011). Additionally, high satisfaction with working relationships may contribute to these effects, as excessive happiness and sociability have been linked to negative career outcomes (Grant and Schwartz, 2011). Our findings support the idea that moderate well-being levels are more beneficial (Oishi et al., 2007).

Further, our results indicate that school relationships have the strongest link to student achievement, highlighting their role in teacher well-being and educational outcomes. This is not unexpected, given the inherently social nature of the teaching profession. In this setting, optimal workplace relationships, characterized by harmonious interactions, promote collaboration and enhance educational effectiveness among teachers (Harter et al., 2003). However, an overemphasis can deter constructive feedback, perpetuate ineffective practices, and divert focus from core responsibilities like lesson planning. Excessive closeness can also compromise objectivity in pedagogical decision-making, potentially encouraging favoritism and hindering the application of sanctions. This underscores the necessity of maintaining a balanced approach to professional relationships within educational settings. Previous studies in organizational psychology could support these hypotheses suggesting that close workplace relationships can erode organizational environments (Pillemer and Rothbard, 2018).

This paper contributes to understanding the ambiguous or inconclusive results of previous research on the relationship between TWSB and learning outcomes (Hascher and Waber, 2021; Hoque et al., 2023; Maricuțoiu et al., 2023). It underscores that the salience of this relationship extends beyond the realm of workplace aspects of teachers' well-being. A thorough understanding of teachers is essential for analyzing their performance and its implications for learning outcomes. Furthermore, the introduction of the TMGT effect, an element hitherto overlooked in the literature, accentuates that heightened well-being levels may not uniformly translate to enhanced outcomes, even within educational contexts.

Our findings support the idea that TSWB may be for policymakers a variable with a high potential to exert influence. Recognizing the link between TSWB and student success enriches the traditional education production function, giving a wider scope for effective educational policies. Positive interventions for improving current teachers' relationships, including personal and professional development, and managerial skills for school principals, could be considered to improve teachers' subjective well-being and thereby boost their effectiveness in the short term. In policy terms, this paper introduced a psychometric tool for assessing TSWB, which has been validated in a substantial and representative sample. Employing this questionnaire with diverse teacher populations may pinpoint areas of dissatisfaction, enabling policymakers to tailor interventions addressing specific concerns. Furthermore, the findings highlight the importance of interpersonal relationships in schools for both teacher well-being and student learning, underscoring the need for policies that foster positive school relationships.

This study has two main limitations. First, the analysis is restricted to the survey's predefined dimensions of teacher well-being, which future qualitative research could expand. Second, while we examine the relationship between teacher well-being and student learning, this study does not establish causality due to data limitations. Notably, since individual students could not be matched with their respective teachers, the analysis was conducted at the aggregated school level.

Finally, promising avenues for further exploration include causal analysis, the role of mediating and moderating variables, and the potential impacts of student achievement on teachers' well-being at the organizational level, even though previous evidence at the individual level suggests that this reverse causality may not hold (Kidger et al., 2016).

Data availability

Notes

1 While ENDO has five available editions, we excluded 2020 and 2021 because the methodology shifted to phone surveys with reduced questions. Likewise, 2014 was also excluded due to variations in items and well-being scales, featuring six Likert-type options, in contrast to the four options in 2016 and 2018. Consequently, our analysis focuses on the data from these two specific years.

2 Preschool teachers are excluded to align with available student test scores data. Additionally, private schools are excluded given their autonomy and vast heterogeneity in educational quality (Díaz and Ñopo, 2016; Minedu, 2018).

3 Similar items have already been used to measure subjective well-being in Peruvian psychological research (Yamamoto, 2017; Yamamoto et al., 2008). The distribution of the eighteen items that inquire about the level of teachers' satisfaction with different aspects of their life and work are presented in Supplementary Table A4.

4 Given our pooled data, the same school may appear in different years. To address this, we define clusters by "school-year", treating each combination as a distinct unit. Clustered standard errors are used in the regression analysis to account for this structure.

5 We closely followed the modern evidence-based best practice procedures compiled by Watkins (2022).

6 Here we discuss only the results for factor 1, since the conclusions are similar for the other factors.

7 For instance, "whereas having too little time is indeed linked to lower subjective well-being caused by stress, having more time does not continually translate to greater subjective well-being. Having an abundance of discretionary time is sometimes even linked to lower subjective well-being because of a lacking sense of productivity" (Sharif et al., 2021, p. 1).

8 Our sample includes 3675 schools present in both ECE and ENDO. Missing data are minimal, with 69 schools lacking TSWB variables and 60 missing the number of classrooms from the School Census, representing less than 2% of the sample. Our analyses show no evidence of bias. Listwise deletion provides unbiased and consistent estimates under the Missing Completely at Random assumption. A means comparison test on school characteristics found no significant differences between excluded and retained schools, supporting the validity of our approach.

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Author contributions

J.M.R.: Conceptualization, Methodology, Data analysis, Writing – Original Draft, Writing – Review & Editing. D.S.: Conceptualization, Methodology, Data Analysis, Writing – Original Draft, Writing – Review & Editing. Both authors read and approved the final manuscript. Correspondence to: J.M.R.

Competing interests

The authors declare no competing interests.

Ethical approval

This study did not require ethical approval because it involved only a secondary analysis of publicly available fully anonymized datasets from the Peruvian Ministry of Education. No new data were collected and no human participants were directly involved.

Informed consent

Informed consent was not applicable to this study, as the analysis was conducted on publicly accessible datasets from the Peruvian Ministry of Education with no identifiable personal information.

Additional information

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