# Occupational self-efficacy scale: Validity in teachers

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ABSTRACT

Occupational self-efficacy has gained attention because of its importance in understanding the effects of psychosocial factors at work, but because of its relevance, it is necessary to study it in the context of the COVID-19 pandemic. The Occupational Self-Efficacy Short Scale Form (OSS-SF) is a measure of individual variability in self-efficacy within the work context and has been used in some studies in Latin America. The aim of this study was to obtain evidence of the validity of the OSS-SF for 214 Peruvian teachers and to evaluate its internal structure and associations with other constructs. The sample, composed of 214 teachers ($M_{age} = 44$, $SD_{age} = 10$), was selected using nonprobabilistic convenience sampling and evaluated via online forms. Nonparametric item response theory was used. Among the results, a unidimensional structure and high scalability at the item and scale levels were obtained ($>0.70$). The reliability was approximately 0.90. There was moderate convergence with job satisfaction (0.39) and slight convergence with the perception of the management of virtual tools (0.18). The OSS-SF is a scale with adequate evidence of validity and reliability for Peruvian teachers who work remotely. Therefore, it can be used as a diagnostic measure of intervention and training needs to benefit teachers and students.

## 1. Introduction

Self-efficacy is a construct with substantial evidence, and as such, it has been widely studied as an excellent predictor of a variety of behaviours (Calabro et al., 2023; Ghasemi et al., 2019; Yu et al., 2022; Zhu et al., 2023). It is defined as an individual's beliefs about his or her own capabilities that guide personal behaviour and enable the individual to achieve certain accomplishments that impact his or her life (Bandura, 1997, 2009). Furthermore, self-efficacy requires people to convince themselves of what they are capable of doing and the expected results they can achieve (Bandura, 2014; Lyons & Bandura, 2018) and to decide the degree of effort and time they are willing to invest in a particular endeavour (Bandura, 1997, 2009; Lyons & Bandura, 2018; Fida et al., 2022). In this sense, self-efficacy guides coping behaviours and influences physiological reactions (Fida et al., 2022), motivation, affect, and thinking (Bandura, 1982). Moreover, it drives innovative actualization (Bandura, 2009), which, by interacting with self-regulated learning, promotes self-development (Lyons & Bandura, 2018).

Social cognitive theory underpins the construct of self-efficacy, while its assumptions explain personal and social agency (Bandura, 1997, 2006). According to theory, motivations, affects, and behaviours are governed not by objective facts but by people's beliefs about their causal capacities, especially with respect to self-efficacy (Bandura, 1997). In other words, the individual is self-influenced to reflect on his or her judgements regarding events and to modify personal thoughts and strategies in a relationship of mutual dependence with their environment (Bandura, 1997), where self-efficacy is based on the cognitive processing of information sources in an active, physiological, indirect and social way (Bandura, 2014).

Self-efficacy has a general meaning and is therefore applied to different specific areas of human development. General self-efficacy is relatively stable over time and is conceived as a trait variable applicable to a wide variety of situations (Miyoshi, 2011; Yeo & Neal, 2006), whereas specific self-efficacy involves differentiated beliefs in various behavioural domains (Bandura, 2019).

One of the specific domains of self-efficacy is work-related, i.e., it

refers to beliefs in one's own ability to achieve adequate performance goals at work (Rigotti et al., 2008; Schyns & von Collani, 2002); however, it is not restricted to task functioning as it also has a positive effect on the emotional and social spheres (Fida et al., 2022). Thus, those who possess high personal and team efficacy beliefs are not affected by heavy workloads, but rather, they manage such situations effectively. This tends to lead to effective stress management due to a perception of control over the situation (Bandura, 2009).

The COVID-19 pandemic erupted as a critical event that challenged teachers' self-efficacy and impacted the teaching-learning process by forcing the continuity of teaching to be achieved through remote work, which required that teachers accept the absence of face-to-face contact and adjust to a more confined environment. With respect to teachers, the health crisis was characterized by fear of contagion (Santa-Cruz-Espinoza et al., 2022b; Baldi & Savastano, 2021), anxiety, depression (Ramírez-Ortiz et al., 2020; Wang et al., 2020) and stress (Santa-Cruz-Espinoza et al., 2022a; Dhawan, 2020; Steigleder et al., 2023), all of which are associated with the use of new technologies, uncertainty due to the pandemic, work overload, problematic relationships with students, and organizational issues (Santa-Cruz-Espinoza et al., 2022a). This new teaching modality required greater self-discipline in students to achieve academic objectives and required teachers to use different strategies to capture the attention and maintain the academic motivation of students during online classes (Srivastava, Kumar, & Mehrotra, 2023).

### 1.1. Teacher self-efficacy: relevance and measurement

Teacher self-efficacy refers to the judgements or beliefs that teachers have about their ability to achieve academic goals (Tschannen-Moran & Woolfolk Hoy, 2001). As such, it tends to favour and depend on students because teacher self-efficacy involves their (the students) participation and learning (Tschannen-Moran & Woolfolk Hoy, 2001; Emiru & Gedifew, 2024), influences their performance, impacts the quality of their interactions (Perera & John, 2020), drives autonomous motivation (Girelli et al., 2018) and satisfaction (Lazarides & Schiefele, 2024) and reduces inappropriate behaviours (Kengatharan & Gnanarajan, 2023). In other words, teachers' self-efficacy positively influences not only the academic performance of students but also impacts the affective, behavioural, and motivational aspects of students and their well-being.

The benefits of self-efficacy for teachers have also been documented with empirical evidence indicating that teacher self-efficacy is associated with work engagement (Edokpolor et al., 2022; Tschannen-Moran & Woolfolk Hoy, 2001). Moreover, this empirical evidence predicts better quality of work life (Jaguaco et al., 2022) and contributes to a greater sense of well-being (Lee, Fung, Daep Datu, & Chung, 2024). Therefore, high self-efficacy constitutes a personal resource that motivates teachers and favours the context in which they develop professionally.

Due to the COVID-19 pandemic, teachers had to work remotely, thus testing their abilities in many ways. The study showed that self-efficacy in online teaching actually played a protective role by, mediating the relationship between videoconference fatigue and burnout in teachers (Gazandinda, Yudhistira, & Medellín, 2024). Not only did teachers have to exert greater effort to gain the attention of their students, which was difficult to do in an online environment (Srivastava, Kumar, & Mehrotra, 2023), but they also had to learn to use virtual tools and redesign or even develop new lessons in some cases, while also meeting the needs of parents and supervisors.

Online teachers' self-efficacy was associated with their connections with students in the absence of institutional and peer support (Leino, Kaqinari, Makarova, & Döring, 2024). As the perceived usefulness of the technology acceptance model influenced teachers' self-efficacy in online teaching (Wang, Cardullo, Burton, Slisbury-Glennon, & Serafini, 2023), it was also determined that teachers' self-efficacy played an important role as they learned to cope with new challenges, and it positively influenced the intention to continue using virtual tools in higher education teaching (Gonzalez, Gomez, Chamorro-Mera, & Perez-Mayo, 2023).

The scientific evidence presented herein highlights the relevance of research related to self-efficacy and the need to be able to measure teacher self-efficacy. The extant literature presents several measures of self-efficacy related to the work context. For example, the E-Work Self-Efficacy Scale (Tramontano et al., 2021) has a multidimensional construct that includes self-efficacy skills, confidence-building, self-care, and remote social and emotional self-efficacy. However, the flexible nature of remote work represented in the aforementioned scale is not applicable to teachers because their work schedules are rigidly managed by the educational institutions (Tramontano et al., 2021).

For the teaching population, the teaching self-efficacy scale is a multidimensional measure (Tschannen-Moran & Woolfolk Hoy, 2001) designed for American teachers and adapted for Peruvian public schoolteachers (Dominguez-Lara, Fernández-Arata, Merino-Soto, Navarro-Loli and Calderón-De la Cruz, 2019). However, it has been constructed for a face-to-face work context. Another measurement option is the collective teacher self-efficacy scale (Sánchez-Rosas et al., 2020), which measures the beliefs shared by schoolteachers to take joint action in favour of students. However, during the pandemic, there was little collective work or peer support for teachers, and, moreover, the characteristics of the scale were not applicable to higher education teachers.

One of the instruments that has shown versatility, owing to its application in different professional/occupational fields, is the occupational self-efficacy-short scale form OSS-SF, whose original version is in German (Schyns & von Collani, 2002). It was constructed to evaluate occupational domains and to compare different jobs (Schyns & von Collani, 2002). It has been studied in samples of hospitals, retail stores and temporary employment agencies (Schyns & von Collani, 2002) and administered to professionals in charge of child and adolescent care (Rigotti et al., 2008), workers in various occupations dealing mostly with university and technical studies (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021), and academic professionals (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Schyns & von Collani, 2002).

The OSS-SF presents an invariant structure in Germany, Belgium, Spain, the United Kingdom and Sweden (Rigotti et al., 2008) and exhibits excellent psychometric properties (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Rigotti et al., 2008; Schyns & von Collani, 2002). The shortened six-item version has been found to be superior to the original 19-item version (Schyns & von Collani, 2002). Overall, the instrument is associated with perceived job performance (Rigotti et al., 2008), positive and negative affect at work (Figueiredo Damásio et al., 2014), stress overload, distress, cognitive difficulties (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021), general self-efficacy, internal locus of control, affective commitment, task demands, job satisfaction, and neuroticism (Schyns & von Collani, 2002).

Research has revealed that the OSS-SF is a test aimed at measuring occupational self-efficacy with a general nature. Because of its short length, it can be used for organizational diagnosis without the risk of fatigue. The construct it measures is relevant to occupational health, e. g., as a protective factor against occupational hazards (Emiru & Gedifew, 2024; Gazandinda, Yudhistira, & Medellín, 2024); (Wang, Cardullo, Burton, Slisbury-Glennon, & Serafini, 2023), and it is of interest to the population of teachers who experience high stress due to the demands of their work (Gonzalez, Gomez, Chamorro-Mera, & Perez-Mayo, 2023). In addition, the applicability to this professional field allows for comparisons with workers in other fields.

The psychometric properties of the OSS-SF have recently been investigated in Peru, and although the evidence reported was adequate, the findings are based on a relatively small heterogeneous sample (Ferrari & Filippi, 2009) of workers with different occupations working

in the face-to-face modality (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021). This justifies conducting a psychometric study to assess whether the scale maintains validity in a remote work setting during the pandemic among an exclusive sample of teachers. Furthermore, in the previous study, convergence was obtained with other variables (overload, distress, efficacy in the presence of difficulties and cognitive difficulties), but neither job satisfaction nor the use of virtual tools or professional experience was considered.

Therefore, it is necessary that the OSS-SF scale be applicable to teaching populations that perform remote work. For this purpose, the objective was to determine the psychometric properties of the OSS-SF for Peruvian teachers who perform telework by obtaining evidence of validity on the basis of the internal structure and the relationships with other variables (age, work experience, and job satisfaction). In the present study, these aspects are framed in the "Standards" (American Educational Research Association et al., 2018), in which the accumulation of evidence of validity for the interpretation and use of a measure is a continuous process.

### 1.2. Basis for the hypotheses

Previous research has shown evidence in favour of the unidimensional structure of the OSS-SF scale (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Figueiredo Damásio et al., 2014; Rigotti et al., 2008; Schyns & von Collani, 2002). Because these reports were generated in a nonteaching population, the present investigation could contribute new evidence regarding the internal structure of the instrument in the context of remote work during the COVID-19 pandemic. This new context was characterized by fear of contagion (Baldi & Savastano, 2021; (Santa-Cruz-Espinoza et al., 2022b), anxiety, depression (Ramírez-Ortiz et al., 2020; Wang et al., 2020) and stress in teachers associated with the use of new technologies, uncertainty due to the pandemic, work overload, relationships with students, and organizational factors (Santa-Cruz-Espinoza et al., 2022a). Therefore, the following hypothesis is proposed: (h1) The scale has a unidimensional structure.

The relationships of occupational self-efficacy with age and work experience constitute a research gap, as they have not been addressed in studies conducted in the Peruvian context (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021). However, previous research has indicated that both age and work experience are positively associated with occupational self-efficacy. One investigation revealed that younger remote workers were distrustful, more self-protective, and less experienced in working remotely (Tramontano et al., 2021). Another study reported that age, as an indicator of experience, is linked to occupational self-efficacy (Rigotti et al., 2008). Thus, advanced age and increased experience at work could be associated with the greater development of occupational competencies acquired by the worker in the praxis of his or her career, as well as in the training received, learning from mistakes, and coping with difficult or new situations during work.

The different experiences acquired at work according to social cognitive theory constitute the sources of evidence that influence self-efficacy in the following ways: actively, through previous achievements; indirectly, by following models and observing other people achieve goals; and socially, through persuasion, training, and feedback on performance (Bandura, 2014). All of these are achieved through the learning acquired on the job and over time. Consequently, the hypotheses derived from the reported findings are as follows: occupational self-efficacy is positively related to age (h2), professional experience (h3), and perceived skill in handling virtual tools (h4).

With respect to gender, the literature is inconclusive due to discrepant findings. One study revealed greater occupational self-efficacy in females than in males (Alessandri et al., 2021), whereas no gender differences in occupational self-efficacy were found in participants from Belgium, Germany, Spain, Sweden, or the United Kingdom (Rigotti et al., 2008). As these differences could be attributed to culturally assigned gender roles, it was necessary to consider that the participants in this study were teachers in the Peruvian context, and even though Peru is a multicultural country, it is characterized by male dominance, i.e., machismo/manliness (Mamani López et al., 2020). Therefore, the inequality attributed to gender roles could mark differences in occupational self-efficacy, which is why it is hypothesized that (h5) occupational self-efficacy differs according to gender.

Regarding the relationship between occupational self-efficacy and job satisfaction, there is evidence supporting this relationship among remote workers (Tramontano, Grant and Clarke, 2021) and among those who perform face-to-face work (Rigotti et al., 2008). In addition, self-efficacy is related to work commitment (Edokpolor et al., 2022). Thus, the evidence seems to support the theoretical approaches that when people with self-efficacy are confident in what they are capable of achieving (Bandura, 2014), they are perceived to be self-motivated (Bandura, 2009), which would explain the expected relationship with job satisfaction. Given the above, it is hypothesized that (h6) the OSS-SF scale converges with job satisfaction.

## 2. Materials and methods

### 2.1. Participants

The reference population was composed of Peruvian teachers who were teleworking due to the COVID-19 pandemic. The sample consisted of 235 teachers selected by nonprobabilistic convenience sampling due to quarantine measures for the containment of the contagion. The participants were predominantly female (64.7 %) and had varying levels of education, specifically, secondary (45.4 %) and primary (31.1 %) education, followed by higher education (14.9 %) and initial education (7.7 %). They majority were married (51.9 %) or cohabiting (12.8 %), followed by single (30.6 %), divorced (3 %) and widowed (1.7 %). The participants were aged between 21 and 72 years (M = 44, SD = 10) and were primarily from the northern region of Peru and from the departments of Piura (55.3 %) and La Libertad (41.3 %). Regarding the number of children, 55.3 % had no children, 41.3 % had 2 children, and 3.4 % had between 3 and 7 children. The age of the children ranged between 1 and 46 years.

### 2.2. Instruments

#### 2.2.1. Occupational Self-Efficacy Scale-Short Form (OSS-SF)
The questionnaire was appropriate for administration to workers of different occupations (Schyns & von Collani, 2002). The scale contained six items phrased in the same direction and scored on a 5-point Likert scale ranging from strongly disagree (1 point) to strongly agree (5 points). The Spanish version was used in the present study (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Rigotti et al., 2008).

#### 2.2.2. Single item for job satisfaction
A single-item measure that was constructed (Dolbier et al., 2005) for a sample of Caucasian, Hispanic, African American, Asian, and Native people, predominantly women, was used. The item, which was easy to apply and interpret (Binh Tran, 2021) read as follows: "To what degree do you feel satisfied with your job, as a whole?" The survey included seven response options, i.e., very dissatisfied, dissatisfied, slightly dissatisfied, neither one nor the other, slightly satisfied, satisfied, very satisfied. The findings revealed positive correlations between job satisfaction and internal locus of control (Binh Tran, 2021), supervisor support and coworker support. However, divergent measures of stress and negativity were reported (Dolbier et al., 2005).

### 2.2.3. Survey of sociodemographic variables

A questionnaire was used to collect sociodemographic information about the participants and find evidence of associations with other variables. Information was collected on age (indicated in years) and professional experience (expressed in years) through questions such as, "How much experience have you had in online teaching?" Technological skills were also measured by asking specific questions such as, "How much skill do you consider you have in the management of virtual tools?" Response options included very good, good, fair, poor, and very poor.

### 2.3. Procedure

### 2.3.1. Design

The research was applied in a cross-sectional and instrumental way as it is oriented towards obtaining the psychometric properties of a measurement instrument at a given point in time.

### 2.3.2. Data collection

The evaluation of the participants was carried out via Google forms through virtual networks (WhatsApp, Facebook, Telegram) and e-mails due to home and social isolation measures to prevent the spread of SARS-CoV-2 (Gonzales-Castillo et al., 2020). The sample selection strategy was intentional (targeting the researchers' contacts) and involved the snowball technique. Communication was established with the teachers known to the researchers, who, in turn, were asked verbally and through the form to disseminate the link to the instruments to their colleagues.

Prior to the application of the instruments, informed consent was obtained from the teachers, who were informed of the purpose of the evaluation, the estimated response time, and the voluntary and anonymous nature of their participation. Those who had any doubts related to the study were encouraged to write to the researchers at their e-mail address. Subsequently, they expressed their decision to participate.

The instruments were applied between May 28 and December 23, 2020, between the first and second waves of the COVID-19 pandemic. The order of application of the tests was as follows: first, the sociodemographic questionnaire; second, the satisfaction test; and, finally, the occupational self-efficacy measure.

### 2.3.3. Analysis

*2.3.3.1. Preliminary analysis.* The data quality was examined to reduce the occurrence of possible careless or insufficient effort responses (Meade & Craig, 2012). For this purpose, the D2 distance index (Mahalanobis, 1936) and the G+ index (Niessen et al., 2016) were used as measures of highly inconsistent response patterns (Niessen et al., 2016). R careless programmes were used (van der Ark, 2012; Yentes & Wilhelm, 2021).

*2.3.3.2. Item analysis.* Owing to the ordinal structure of the items, nonparametric association coefficients were calculated (King et al., 2011) using gender (glass rank biserial coefficient) and age (Spearman correlation). Response similarity was assessed with Friedman's rank sum test, and Kendall's W coefficient was used as the effect size. The efficiency of the response options was evaluated based on their observed frequency and a nonparametric estimate of response intensity, known as the item difficulty index (Iid) on maximal performance tests (Moosbrugger & Kelava, 2020). The Iid is calculated on a scale from 0 to 1.0 by transforming the mean response of each item relative to the maximum response value (option 5 in the OSS-SF). The R *rcompanion* (Mangiafico, 2023), MVN (Korkmaz et al., 2014) and performance packages (Lüdecke et al., 2021) were used.

*2.3.3.3. Internal structure.* A nonparametric approach was used in assessing the psychometric properties of the OSES (van Schuur, 2003; Wind & Wang, 2023), thereby maintaining methodological consistency with the detection of neglected responses (Wind & Wang, 2023). The characteristics of the study design included relatively small sample size limits using parametric estimates from other models that required large samples (e.g., structural equation modelling and item theory response), the presumption of unidimensionality of the OSES, and the predominant use of the observed OSES score to scale people.

Within this parameter and with reference to the Standards (American Educational Research Association et al., 2018), dimensionality, scale fit, item-construct relationships, reliability, and measurement equivalence were observed.

*2.3.3.4. Dimensionality.* In a nonparametric framework, an analysis of the number of latent dimensions was implemented via the following indices: poly-DETECT (Dimensionality Evaluation to Enumerate Contributing Traits index; Zhang, 2007) and ASSI (Approximate Simple Structure Index; Zhang & Stout, 1999). The ASSI and poly-DETECT should be approximately zero to conclude essential unidimensionality (<0.10 [Kim, 1994]; <0.20 [Roussos & Ozbek, 2006]). The R Sirt program (Robitzsch, 2022) was used.

*2.3.3.5. Adjustment of the scale.* Item fit was evaluated in a nonparametric item response theory framework, specifically, the Mokken scaling analysis (MSA; Mokken, 1971), to test several structural properties including scalability and fit to a monotonic homogeneity model (MHM; Mokken, 1971). The MHM requires that the crit indicator, which is based on several quality subcriteria, including the number of MHM violations, be ≤40 (Stochl et al., 2012) or ≤80 (Molenaar & Sijtsma, 2000). The scalability of the items and of the scale itself was evaluated with the H coefficient, which was set at >0.30 as the minimum value (Hemker et al., 1995; Stochl et al., 2012). The R Mokken program was used (van der Ark, 2012).

*2.3.3.6. Item-construct relationship.* As a proxy measure of the item––construct relationship, the corrected item–test correlation was estimated (Henrysson, 1963) using the R performance program (Lüdecke et al., 2021).

*2.3.3.7. Reliability.* The reproducibility of the responses was assessed at two levels, i.e., the score level and the item level. For score reliability, alpha and MS-rho coefficients (Molenaar & Sijtsma, 1988) were estimated. The latter was developed within the framework of the MSA. Item-level reliability was estimated by means of disattenuated correlation at a cut-off point >0.30 (Zijlmans et al., 2018). The R Mokken program (van der Ark, 2012) and the Zijlmans et al. function (Zijlmans et al., 2018) were used.

*2.3.3.8. Measurement equivalence.* The design of this analysis has two limitations, specifically, the relatively small size of each group (<300) and the unbalanced size of the groups (Scott et al., 2009; Wood, 2011). Therefore, a nonparametric differential item functioning (DIF) approach was chosen to provide consistency with the methodology used in this study. The two methods tested two aspects, the existence of DIF (statistical test) and the degree of DIF (i.e., effect size) using Mantel's statistical test $\chi^2$ (Mantel, 1963) and the standardized mean difference (SMD) (Dorans & Schmitt, 1991; Wells, 2021). Mantel $\chi^2$ was implemented with a Bonferroni adjustment to the *p* value = 0.01 (0.01/6 items = 0.001). For SMD comparisons between each item, the value of the maximum possible category of each item was used, i.e., category 5 = strongly agree (Dorans & Schmitt, 1993; Wells, 2021, p. 62). The DIF magnitude levels determined using SMD were as follows: trivial or small (SMD < 0.05), moderate (SMD < 0.10), and large (SMD ≥ 0.10) (Wells, 2021, p. 62). The R MeasInv program (Wells, 2022) was used.

*2.3.3.9. Associations with variables.* Linear correlation was estimated in a standard (nonrobust) and robust (Winzorized; Wilcox, 2016) manner. The correlations were evaluated at the following levels (Lovakov & Agadullina, 2021): very small ($r < 0.12$), small ($r < 0.24$), moderate ($r < 0.41$) and large ($r \geq 0.41$).

## 3. Results

### 3.1. Detection of possible biased responses

Using D2, with a cut-off point $\geq 16.81$, 15 participants (6.3 %) were detected, and using G+ (Min = 0, Max = 45; criterion: $\geq 7.5$–8), 21 participants (8.9 %) were detected. Together, 14 (5.9 %) participants met both criteria, and the classifications obtained according to both criteria were strongly associated (Cramer-V = 0.77; 95 % CI = 0.64, 0.90; x2 = 129.36, df = 1, $p < 0.001$), as were the detection scores (r = 0.90; 95 % CI = 0.87, 0.92). Because of the high convergence and because G+ was derived from nonparametric modelling, scores were removed for G+ identified participants (21, 8.9 %), thereby resulting in an effective sample of 214.

### 3.2. Item analysis

Although the central response differed between items (Friedman's x2 = 24.193, df = 5, $p$ value = 0.0001), the similarity size was moderately high (Kendall W = 0.664; 95 % CI = 0.671, 0.805). According to the results presented in Table 1, the statistical characteristics of the items were considered highly similar with respect to Iid (M = 0.83), dispersion (M = 0.62), and the remaining distributional properties (Sk, Kurt, and AD coefficients). Due to the absence of univariate normality for each item (AD >18.00), the set of items did not maintain multivariate normality (Henze–Zirkler test = 20.790, $p < 0.001$). Overall, all items exhibited statistical behaviour that can be considered highly similar.

### 3.3. Internal structure

#### 3.3.1. Dimensionality
The DETECT and ASSI indices were $-1.99$ and $-0.733$, respectively, indicating accurate item unidimensionality. Hence, the latent unidimensionality of the OSS-SF was deemed acceptable.

#### 3.3.2. Adjustment to the MHM model
The monotonic homogeneity model fit very well because there was no indication of violations (#v) or crit values above the criterion or statistical significance value (#z sig). The results are presented in Table 2 (heading the monotonic homogeneity model). The scalability at the item level (MH = 0.711, Min = 0.676, Max = 0.752) and of the total scale (>0.70) were high (Table 2, heading scalability), clearly exceeding the minimum criteria. Finally, the item-score relationship (rit, Table 2) was also high (M = 0.74, Min = 0.679, Max = 0.792), with values similar to the obtained H coefficients. Fig. 1 shows the monotonic relationship of the response options for each item.

### 3.4. Reliability

The response consistency measured by MS and the alpha coefficients were almost equal (MS-rho = 0.909, alpha = 0.907). At the item level, the items obtained high coefficients that were far from the minimum level (>0.30). Compared with the study by Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021, item consistency was r = $-0.23$, $p = 0.65$ (95 % CI = $-0.87$, 0.71), indicating the absence of a linear association. Hence, similarity was not significantly different from zero (Kendall W = 0.44. $p = 0.48$).

### 3.5. Differential functioning of the items

For the three grouping variables, the Mantel χ2 test results were < 1.20 (Mantel χ2 M for sex = 0.715, age = 0.27, and professional experience = 1.10). None of the differences reached statistical significance at the 0.05 level ($p \geq 0.14$). According to the size of the DIF in all estimates of the three grouping variables, all variables were small (SMD < 0.007, standard SMD < 0.017) and were classified as negligible. Therefore, DIF was absent in the clustering variables studied. The results are presented in Table 3.

### 3.6. Associations with other variables

The statistical significance of the associations remained constant in the robust and nonrobust estimates. Accordingly, age, professional experience and gender were not statistically significant; therefore, the hypotheses of their relationships with occupational self-efficacy were rejected (h2, h3, h5).

The handling of virtual tools (HV handling) and job satisfaction were statistically significant, with the robust estimates of these positive associations being small and moderate, respectively. Consequently, the hypotheses assuming a relationship with occupational self-efficacy were accepted (h4, h6) (Table 4).

**Table 1**
Item analysis: descriptive and association statistics.

| | Moments of distribution (OSS-SF items) | | | | | | Association | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | M | $I_{id}$ | SD | Sk | kurt | AD | Sex | Age |
| oses1 | 4.15 | 0.83 | 0.744 | −1.00 | 2.19 | 18.68 | 0.03 | 0.00 |
| oses2 | 4.16 | 0.83 | 0.597 | −0.73 | 3.44 | 28.48 | 0.06 | 0.13* |
| oses3 | 4.03 | 0.81 | 0.611 | −0.87 | 3.46 | 29.39 | 0.05 | 0.14* |
| oses4 | 4.19 | 0.84 | 0.619 | −0.62 | 2.31 | 24.94 | 0.09 | 0.11 |
| oses5 | 4.17 | 0.84 | 0.586 | −0.60 | 3.18 | 28.61 | 0.00 | 0.13* |
| oses6 | 4.12 | 0.83 | 0.571 | −0.59 | 3.57 | 30.50 | −0.00 | 0.09 |
| | Frequency of response options | | | | | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | – | – | – |
| oses1 | 2 | 3 | 24 | 116 | 69 | – | – | – |
| oses2 | 1 | 1 | 14 | 143 | 55 | – | – | – |
| oses3 | 1 | 3 | 21 | 151 | 38 | – | – | – |
| oses4 | 1 | 0 | 18 | 132 | 63 | – | – | – |
| oses5 | 1 | 0 | 15 | 142 | 56 | – | – | – |
| oses6 | 1 | 0 | 17 | 149 | 47 | – | – | – |

\* $p < 0.05$.

**Table 2**
Mokken scaling analysis: evaluation of the monotonic homogeneity model fit (MHM).

| | Scalability | | Monotonic homogeneity model | | | | Item-score relationship | Item reliability |
|---|---|---|---|---|---|---|---|---|
| | H | se | #ac | #vi | #z sig | crit | Rit | rii |
| oses1 | 0.676 | 0.056 | 0 | 0 | 0 | 0 | 0.679 | 0.509 |
| oses2 | 0.726 | 0.049 | 0 | 0 | 0 | 0 | 0.792 | 0.708 |
| oses3 | 0.752 | 0.045 | 0 | 0 | 0 | 0 | 0.761 | 0.651 |
| oses4 | 0.709 | 0.052 | 0 | 0 | 0 | 0 | 0.761 | 0.651 |
| oses5 | 0.679 | 0.059 | 0 | 0 | 0 | 0 | 0.730 | 0.596 |
| oses6 | 0.730 | 0.050 | 0 | 0 | 0 | 0 | 0.778 | 0.681 |
| Total | 0.711 | 0.048 | – | – | – | – | – | – |

Note: H: scalability coefficient. se: standard error. #ac: number of xxxx. #vi: number of violations. #z sig: number of statistically significant violations. Crit: weighted criterion of fit to MHM. Rit: corrected item-test correlation. Rii: item reliability.
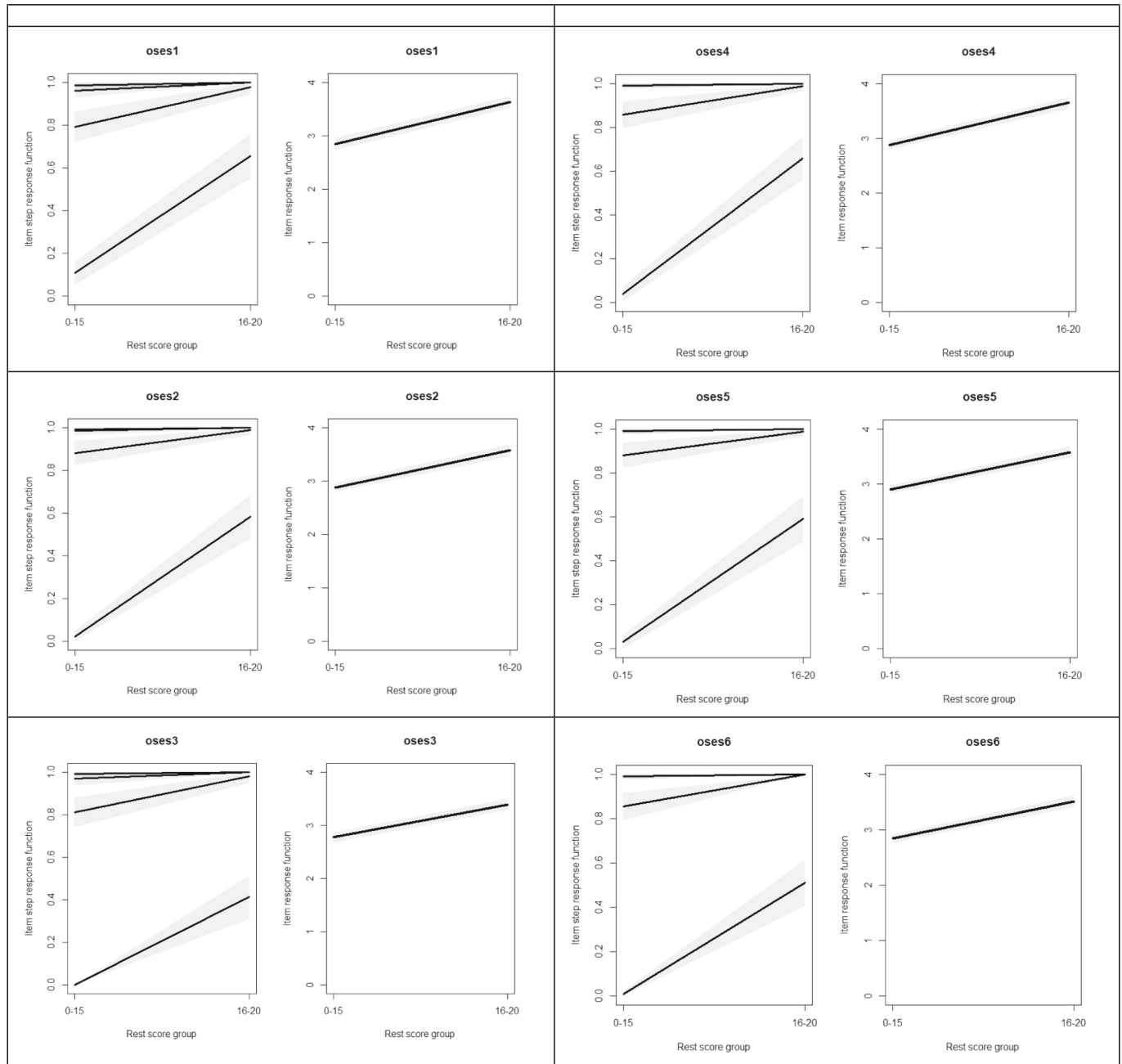


**Fig. 1.** Nonparametric response function of OSES-SF items.

**Table 3**
OSSF: differential operation of items (DIF).

| | DIF statistical test | | DIF effect size | | |
|---|---|---|---|---|---|
| | Mantel x-2 | *p* value | SMD | Stand SMD | Classification |
| Gender | | | | | |
| oses1 | 0.120 | 0.729 | 0.007 | 0.002 | Negligible |
| oses2 | 1.000 | 0.317 | 0.066 | 0.016 | Negligible |
| oses3 | 0.380 | 0.538 | 0.017 | 0.004 | Negligible |
| oses4 | 0.807 | 0.369 | 0.018 | 0.004 | Negligible |
| oses5 | 1.251 | 0.263 | −0.058 | −0.015 | Negligible |
| oses6 | 0.732 | 0.392 | −0.050 | −0.013 | Negligible |
| Age | | | | | |
| oses1 | 0.438 | 0.508 | 0.013 | 0.003 | Negligible |
| oses2 | 0.592 | 0.442 | −0.065 | −0.016 | Negligible |
| oses3 | 0.042 | 0.838 | −0.030 | −0.007 | Negligible |
| oses4 | 0.055 | 0.815 | 0.058 | 0.015 | Negligible |
| oses5 | 0.333 | 0.564 | −0.030 | −0.007 | Negligible |
| oses6 | 0.167 | 0.683 | 0.053 | 0.013 | Negligible |
| Online experience | | | | | |
| oses1 | 0.695 | 0.404 | −0.055 | −0.014 | Negligible |
| oses2 | 1.090 | 0.296 | −0.027 | −0.007 | Negligible |
| oses3 | 0.720 | 0.396 | 0.035 | 0.009 | Negligible |
| oses4 | 2.141 | 0.143 | 0.065 | 0.016 | Negligible |
| oses5 | 0.644 | 0.422 | 0.040 | 0.010 | Negligible |
| oses6 | 1.327 | 0.249 | −0.058 | −0.015 | Negligible |

Note. SMD: standardized mean difference. Stand SMD: standardization of SMD
(see Analysis section).

**Table 4**
Associations with external variables.

| | Correlation | |
|---|---|---|
| | Standard | Robust |
| Age | 0.04 (−0.10, 0.17) | 0.13 (0.00, 0.26) |
| Professional experience | 0.11 (−0.03, 0.24) | 0.13 (−0.01, 0.26) |
| HV management | 0.18* (0.30, 0.05) | 0.23* (0.35, 0.10) |
| Gender | 0.00 (−0.14, 0.13) | 0.11 (−0.24, 0.02) |
| Job satisfaction | 0.39** (0.27, 0.50) | 0.32** (0.19, 0.43) |

\* *p* < 0.05.
\*\* *p* < 0.01.

## 4. Discussion

Occupational self-efficacy is a construct relevant to the organizational context because of its association with variables such as motivation, persistence towards goals, and well-being. Its ability to measure remote work during a pandemic is relevant because of gaps in knowledge and because it is a protective factor against organizational demands, especially in a health emergency scenario. Therefore, the objective of this study was to determine the psychometric properties of the OSS-SF, a short form for Peruvian teachers who perform telework, by obtaining evidence of validity on the basis of the internal structure and relationships with other variables (age, work experience, and job satisfaction).

In a detailed study of the items, high response similarity was found in the mean values and dispersion, which together also concurred with distributional similarity, i.e., univariate asymmetry and kurtosis. This response similarity in the OSS strengthens the unidimensional representation of the items because the different contents sampled by the items correspond in a single construct and are simply different ways in which the construct is expressed behaviourally. Conversely, the associations between the items and demographic variables such as gender and age were zero for the former but approximately 10 for the latter. With respect to age, some associations were statistically significant, albeit the size of the associations was small (<0.15). However, because of the

treatment of categorical variables and the coefficients used, the magnitude of these associations is difficult to establish and determine from other recommendations (e.g., Field, 2017; Gignac & Szodorai, 2016). At the very least, these effect size categorizations point to a small magnitude of the finding (between 0.13 and 0.14).

In assessing the internal structure, the results indicate that a single dimension is sufficient to latently represent the associations among items, i.e., the DETECT (<0.0) and ASSI (<0.0) indices converge on a single dimension. Consistent with the findings of previous validity studies (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Figueiredo Damásio et al., 2014; Rigotti et al., 2008), one implication of these results is that unidimensionality is a generalizable property of the OSS-SF. Thus, future studies may emphasize the investigation of possible method effects. For example, the random intercepts model (Maydeu-Olivares & Coffman, 2006) may be a preferred option in a dimensionality assessment with possible method effects, e.g., questionable responses and acquiescence. According to the nonparametric approach used, i.e., MSA, the OSS score fits well with a monotonic homogeneity model. That is, the OSS score can efficiently differentiate teachers at different levels of the latent attribute. The strength with which the items contribute to this property is similarly high, and they ensure the reproducibility of the score obtained in each evaluation.

The degree of reproducibility is also summarily supported by the reliability at the score level (approximately 0.90) and at the item level (between 0.50 and 0.70). This reliability is similar to that reported in the multicultural studies by Rigotti et al. (2008) and Figueiredo Damásio et al., 2014. That said, in research conducted with a heterogeneous Peruvian sample, the reliability of the scale was greater (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021). Similarly, with respect to the internal consistency of the items, high values were found, as in most previous studies (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Rigotti et al., 2008). Thus, the findings indicate that the variability of the scale linked to measurement error is low. Owing to the high level of precision indicated by the reliability of the OSS score, the potential use of the instrument can be directed not only towards groups but also towards individuals as part of person-based interventions towards.

Occupational self-efficacy showed a small convergence of magnitude with the use of virtual tools. In contrast, there was no relationship with occupational experience among teachers during the COVID-19 pandemic. One of the sources of self-efficacy in teachers is the experience of enactive mastery (Bandura, 1997; Gale et al., 2021; Yada et al., 2019), which involves the achievement of goals as a result of direct action (Gale et al., 2021). This source of self-efficacy is relevant for those with experience, as well as novices, given that the contextual factors of verbal persuasion and availability of resources are important as sources of self-efficacy (Tschannen-Moran & Woolfolk Hoy, 2001). Therefore, both experienced and novice teachers can strengthen their self-efficacy with sources other than mastery or work history.

In the pandemic scenario, as virtual media was necessary to provide continuity to the classes, their management was associated with teacher self-efficacy, although at a low level. Additionally, professional experience is related to self-efficacy also at a low magnitude (Kim & Burić, 2020). However, cognitive flexibility, which could be associated with self-efficacy, was not considered in the present study. This factor may be necessary to adapt face-to-face teaching to virtual teaching in remote areas when health emergency situations exist.

The sources of self-efficacy differ according to the level of teaching experience (Tschannen-Moran & Woolfolk Hoy, 2001); therefore, the assumption that there is greater exposure to sources of self-efficacy with age is discarded. Consequently, the hypothesis positing an association between age and occupational self-efficacy in teachers is rejected. Hence, it is suggested that future research focus on the differences between novice and senior teachers (Gale et al., 2021).

Occupational self-efficacy was also not associated with gender,

which is similar to what was found in a study conducted in five European countries (Rigotti et al., 2008), but it differs from what was found in a study with Italian police cadets, where occupational self-efficacy was found to be greater among women (Alessandri et al., 2021). The findings obtained in the present study indicate that even with the inequalities that exist in Peru, a multicultural country characterized by machismo (Mamani López et al., 2020), occupational self-efficacy beliefs are independent of cultural patterns attributed to gender roles.

A relevant finding that adds to the existing empirical evidence (Rigotti et al., 2008; Schyns & von Collani, 2002; Tramontano et al., 2021) is the convergence between occupational self-efficacy and job satisfaction. According to social cognitive theory (Bandura, 2009, 2014), if people believe in their own ability to perform well, they will strive to achieve their goals and tackle obstacles, which generates motivation. This explains the relationship between occupational self-efficacy and job satisfaction. In addition, organizations that contribute to the development of their workers with guided experiences, effective peer role models and performance feedback promote self-efficacy (Bandura, 2009), which, in turn, results in job satisfaction at the individual level and in the achievement of goals, teamwork and improved performance at the organizational level.

This study has several limitations. First, it was conducted using nonprobabilistic sampling and an online evaluation, which affects the external validity of the findings (Mouta et al., 2021). In addition, the cross-sectional design did not allow us to collect information on possible changes in teachers' occupational self-efficacy on a prepandemic, pandemic or postpandemic continuum. Even though the nature of remote work during the postpandemic period was similar to that during the pandemic, the scenario was developed for experiences of uncertainty and health emergencies. Nonetheless, psychological and social effects could still be present. In addition, the findings obtained in the COVID-19 scenario may be useful for possible future health crises as well as for future studies conducted to reaffirm or discuss the reported results.

Finally, the OSS-SF scale has favourable validity and reliability for Peruvian teachers, and favourable psychometric evidence for the instrument was obtained (Merino-Soto, Lima-Mendoza, Lozano-Huamán, Calderón de la Cruz, & Juárez-García, 2021; Figueiredo Damásio et al., 2014; Rigotti et al., 2008). In addition, the use of the scale provides a valuable source of information due to its relationship with job satisfaction, which was found in this study, and its association with other variables as reported in previous studies, such as those related to well-being (Yin et al., 2023), perseverance in achieving objectives (Bandura, 1997; Fida et al., 2022), commitment and work performance (Edokpolor et al., 2022).

## 5. Conclusion

The OSS-SF is a scale with a unidimensional structure whose evidence of validity and reliability was obtained in a study of Peruvian teachers who worked remotely during the COVID-19 pandemic. Furthermore, its theoretical structure was confirmed along with empirical evidence from other contexts and occupational samples. The OSS-SF can be used as a diagnostic measure of self-efficacy before and after organizational interventions to strengthen employees' work and personal competencies. In addition, its measurements provide a valuable source of information due to its relationship with job satisfaction, which was identified in this study, and its association with other variables, as reported in previous studies, such as those related to well-being (Edokpolor et al., 2022), perseverance in achieving goals (Bandura, 1997; Emiru & Gedifew, 2024), commitment and job performance (Jaguaco et al., 2022).

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## Institutional review board statement

The study was conducted in accordance with the international ethical standards established by the Declaration of Helsinki, the Belmont Report and the Code of Ethics of the American Psychological Association. An evaluation by an ethics committee was not requested because the study did not pose any risk to the participants. Respect for dignity, self-determination, and confidentiality of the information was ensured.

## Informed consent statement

Informed consent was obtained from all subjects involved in the study.

## CRediT authorship contribution statement

**Henry Santa-Cruz-Espinoza:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Gina Chávez-Ventura:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Julio Dominguez-Vergara:** Writing – review & editing, Writing – original draft, Validation, Software, Investigation, Formal analysis, Conceptualization. **César Merino-Soto:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Methodology, Formal analysis, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no conflicts of interest.

## Data availability

Data will be made available on request.

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