International Education Studies; Vol. 17, No. 4; 2024
ISSN 1913-9020 E-ISSN 1913-9039
Published by Canadian Center of Science and Education

The Effort-Reward Imbalance Questionnaire for Teachers: Psychometric Properties Using the Bifactor ESEM Framework

Christophe Dierendonck[1]

[1] Department of Education and Social Work, University of Luxembourg, Luxembourg

Correspondence: Christophe Dierendonck, Department of Education and Social Work, University of Luxembourg, Luxembourg. E-mail: Christophe.dierendonck@uni.lu

Received: January 28, 2024 Accepted: March 21, 2024 Online Published: July 17, 2024

doi:10.5539/ies.v17n4p1 URL: https://doi.org/10.5539/ies.v17n4p1

Abstract

This study is aimed at validating the French version of the Effort-Reward Imbalance Questionnaire for Teachers. The instrument was pretested before being administered in a large-scale study with elementary school teachers. Dimensionality of the instrument was examined using the bifactor exploratory structural equation modeling (ESEM) framework. The bifactor ESEM model showed the best fitting indices and parameters. Importantly, results suggested the existence of a continuum for ERI data concerning elementary teachers. The instrument showed concurrent validity with several measures of mental health, job satisfaction and work-life balance.

Keywords: effort-reward imbalance, exploratory structural equation modeling, factorial structure, overcommitment, psychometric analysis, teachers, well-being

1. Introduction

Having a valid and reliable tool for measuring teachers' effort-reward imbalance can bring important theoretical and practical contributions to the study of teachers' occupational health psychology and to inform well-being policies. This can lead to the development of more refined theories about the causes and consequences of stress in the teaching profession. By assessing teachers' perception of fairness and justice in their work and by identifying specific job stressors, it is possible to better understand the unique challenges teachers face and it can inform the development of prevention and management strategies about stress and burnout.

In the absence of tools developed specifically for teachers, Ren et al. (2019) have developed and validated the effort-reward imbalance questionnaire for teachers (*Teacher ERIQ*) based on the effort-reward imbalance (ERI) theoretical model and instruments developed by Siegrist (1996), but with some specific adaptations to better take account of teachers' unique psychosocial work environment. As stated by Ren et al. (2019), teachers indeed encounter a greater demand for emotional than physical resources in their daily work. They have to manage the academic, emotional, and behavioral concerns of numerous students while expressing their own emotions appropriately. They also have to contend with high safety and educational expectations coming from their superiors, the parents and the larger community. Finally, teachers tend to extend their commitment beyond formal working hours as they engage in at home activities such schoolwork or homework evaluation, and course preparation, leading to a blurring of the boundaries between professional and personal life.

The current study is aimed at validating a French version of the *Teacher ERIQ* by examining (1) its factorial structure through the bifactor exploratory structural equation modeling framework (bifactor ESEM, Morin et al., 2016) and (2) its construct validity with self-reported measures of health, job engagement, job satisfaction and work-life balance.

1.1 The ERI Model

According to Siegrist (1996) and Siegrist et al. (2016), the ERI assesses adverse health effects on stressful experience at work model and is based on the principle of social reciprocity. Efforts expended due to job demands and obligations are compared with rewards received such as financial compensation, esteem, security and/or perspectives for career. The model posits that when reciprocity is lacking (resulting from high efforts coupled with insufficient rewards), powerful negative emotions and stress are generated, which can have long-term detrimental effects on health. These negative emotions and stress responses are more frequent among persons concerned by over-commitment (i.e., excessive engagement and desire of being in control). In the

model, effort and reward are considered as extrinsic components while over-commitment represents the intrinsic component.

The dimensionality of the ERI model has been examined in a lot of studies in various countries and working fields, using diverse analysis techniques (e.g., Babamiri et al., 2018; Rantanen et al., 2013; Ren et al., 2019; Siegrist et al., 2004; Tsutsumi et al., 2001; Zurlo et al., 2010). According to the reference study of Siegrist et al. (2004) conducted with five samples and later work (Siegrist et al., 2014, 2019), the factorial structure of the ERI model can be depicted as a third-order structure with three second-order factors (effort, reward, over-commitment) and the reward factor composed of three subdimensions (esteem, job promotion, job security). As highlighted by Rantanen et al. (2013), this factorial structure was previously only tested in separate confirmatory factor analysis (CFA) models instead of testing the full ERI model simultaneously. In their study, Rantanen et al. (2013) examined the hierarchical structure of the ERI data with two samples of Finnish managers and young professionals. They showed in both samples the adequacy of a second-order structure with three separate correlated latent factors (two first-order factors of effort and over-commitment) and one second-order factor (reward). The second-order reward factor was composed of three latent factors (esteem, career opportunities, and job security), as expected by the theoretical model. To our knowledge, this study was one of the rare studies having examined the hierarchical structure of the ERI model.

In almost all studies using the ERI model, an effort-reward ratio is calculated as suggested by Siegrist et al. (2004) according to the formula e/(r x c) where e is the sum score of effort items, r is the sum score of reward items, and c is a correction factor taking into account the number of effort and reward items, so that an ERI indicator close to 0 indicates a favorable situation (low effort, high reward) whereas values beyond 1 indicate high effort and low reward. Importantly, Siegrist et al. (2004) suggested that this effort-reward ratio serves as an approximate estimate of the costs and gains experienced in everyday working life that are not repeatedly subject to explicit reasoning on trade-off by working people themselves. According to the authors, the use of a continuous measure has moreover the advantage of providing more information and generating more robust statistical effects compared to binary measures.

Two comments should be made regarding the calculation of the ERI score. Firstly, it should be noted that the ERI ratio does not consider the information provided by the overcommitment items. In this respect, the ERI theory may suffer from a lack of coherence since the status of the intrinsic component of stressful is still in debate. In some studies, the over-commitment dimension is not included in the ERI model (e.g., Ren et al, 2019; Useche et al., 2021). Some other studies have showed that over-commitment acts as a moderator of the relationships between effort-reward imbalance and health (e.g., Jolivet et al., 2010) while other studies (e.g., Preckel et al., 2007) showed no interaction effects of ERI and over-commitment on health measures. In their systematic review, Siegrist et al. (2016) concluded that the moderation hypothesis was not confirmed in most previous studies, suggesting a direct effect of over-commitment on health. They however highlighted that some substantial correlations between over-commitment, effort, and reward scales were observed. Secondly, if the objective is to have a measure of the imbalance between extrinsic and intrinsic components of working people's wellbeing expressed on a metric scale, one may wonder why the hypothesis of the existence of a ERI continuum has not yet been tested through the factorial analyses carried out in previous studies, as in the case for self-determination theory (e.g., Ryan and Deci, 2017) and other measures of psychological wellbeing at work (Morin et al., 2017).

1.2 The ERI Model Applied to Teachers' Work Environment

The ERI model has been applied in the field of education in several studies (Unterbrink et al., 2008; Lehr et al., 2009, 2010; Loerbroks et al., 2014; Hinz et al., 2016; Wang et al., 2015; Zurlo et al., 2010), but, according to Ren et al. (2019), almost all of these studies used the original ERI questionnaire initially developed for employees, largely ignoring the specificity of teachers' work environment (for details about this specificity, see Ren et al., 2019). Considering that the original ERI questionnaire cannot be generalized to teachers, these authors developed the *Teacher ERIQ*. Importantly, Ren et al. (2019) considered that (1) over-commitment items should be analyzed apart from the ERI model, (2) effort factor was composed of four subdimensions, and (3) reward factor was composed of two subdimensions, while the theoretical ERI model postulates a single-factor model for effort and a three-factor model for reward. The *Teacher ERIQ* assessed effort with 14 items and reward with 14 items. Over-commitment was assessed separately with 6 items. For the effort items, three hypothetical CFA models were compared: (E1) one-factor model, (E3) three-factor model (workload, social responsibility, emotional demands), and (E4) four-factor model (workload, student-related issues, emotional demands, and social responsibility). For the reward items, two CFA models were contrasted: (R1) one-factor model, and (R2) two-factor model (emotional reward and material reward). A full measurement model based on

E4 and R2 models was tested, but, surprisingly, exact fit indices of this model were not reported in the article. Authors just reported that goodness-of-fit indexes were excellent and that all factors had high standardized factor loadings (0.433–0.806). Unfortunately, authors did not test the full theoretical model with a single factor for effort, three factors for reward and one factor for over-commitment.

1.3 The Present Study

While we must acknowledge the relevance of the modifications made by Ren et al. (2019) to the ERI questionnaire so that it is better adapted to the teachers' working environment, it is regrettable that the new proposed representations were not contrasted with the original theoretical model. This would have made it possible to rule out or not the possibility that the original model offered the best fit for the data collected.

Moreover, in line with the idea that a continuous measure of effort-reward imbalance is useful, we will test the assumption that people's effort-reward imbalance can be situated on a continuum with over-commitment and reward at highest and lowest points of the continuum respectively, and effort at the middle point.

In the present study, the original model and models advocated by Ren et al. (2019) will be contrasted with alternative factorial representations using the bifactor ESEM framework (Morin et al., 2016, 2020, 2021, 2022). This analytical framework addresses two sources of psychometric multidimensionality often observed when the constructs are hierarchically ordered or in factor indicators which tend to truly reflect more than one dimension (see the data analysis section for more details). The bifactor ESEM framework is based on a systematic comparison of rival models. The selection of the optimal representation of the data is based on goodness-of-fit indices, but also on a close examination of factor loadings, cross-loadings, and factor intercorrelations for each model. It's noteworthy that although bifactor models often exhibit improved goodness-of-fit indicators (Bonifay et al., 2017) factorial representations must be supported in theory (Morin et al., 2020).

We hypothesize that the bifactor-ESEM solution will provide the most accurate representation of teachers' ratings of effort-reward imbalance and that the structure of effort-reward imbalance can be seen as a continuum from over-commitment to reward.

2. Method

2.1 Procedure and Participants

In late 2021, a national consultation commissioned by the National Observatory for School Quality was organised for the 5905 teachers working in Luxembourgish public elementary schools. The study was approved by the Ethic Review Panel of the University of Luxembourg. Every teacher received a unique access code giving access to one of the six versions of the questionnaire designed to cover a range of topics. The six versions of the questionnaire included both common and specific items, which explain why not all teachers responded to all the items. Participation in the consultation was anonymous and not compulsory. The questionnaire was administered via Qualtrics. While it was anticipated to take approximately 50–60 minutes to complete, some teachers required between 60 and 90 minutes to finish the questionnaire entirely. Analysis of the log data revealed that many of them completed a portion of the questionnaire on one day and the remainder on another day, consistent with the survey instructions. However, of the 1825 teachers who participated in the survey, a significant number of them (825) did not reach the end of the questionnaire. As shown in Table 1, this subsample of 825 participants was not substantially different from the subsample of 1000 participants who reached the end of the questionnaire. As a result, we decided to analyse all available data, considering that even the data from partially completed questionnaires were quality data.

Table 1. Description of the two subsamples

	N=1000 subsample	N=825 subsample
Mean experience in years	14.8	12.4
% women	80.0	81.9
% of teachers in cycle 1	23.2	23.5
% of teachers in cycle 2	25.5	25.9
% of teachers in cycle 3	23.2	17.3
% of teachers in cycle 4	19.2	24.7
% of teachers working in several cycles	8.9	8.6

2.2 Instrument and Measures

2.2.1 Teacher ERIQ

We translated the *Teacher ERIQ* in French following the International Testing Commission (ITC) Guidelines for Translating and Adapting Tests (ITC, 2017). A classical translation-back translation procedure was conducted by two experts in the field of Education and fluent in French and English. The original items were first translated into French by one of the experts. The second expert then independently translated these items back to the original language without having seen the original items. Discrepancies between the original version and the back-translated version were systematically examined and resolved by consensus. Items were pretested with a convenience sample of 88 teachers.

Descriptive statistics for the 34 items of the *Teacher ERIQ* are given in Table A1 in the appendix. Unlike the original 5-point Likert scale, all items in the present study were rated using a six-point scale (1=Totally disagree, 2=Disagree, 3=Rather disagree, 4=Rather agree, 5=Agree, 6=Totally agree) to avoid the central tendency phenomenon. According to Ren et al. (2019), the effort scale is composed of four subdimensions and the reward scale includes two subdimensions while the theoretical ERI model postulates a single-factor model for effort and a three-factor model for reward (esteem, job promotion, job security).

Effort-workload refers to the amount of effort spent to face the extrinsic work demands and to the blurred working and non-working time boundaries. It was measured with 4 items (e.g., *My work often gets in the way of the spare time of my own*).

Effort-Social responsibility refers to the amount of effort spent to face high society's expectations in terms of protection, education, and learning. It was measured with 4 items (e.g., *Compared with other professions, society puts high demands on teachers in all aspects.)*.

Effort-Emotional demands refer to the amount of effort spent to pay attention to and understand the emotions of each student or to deal with discipline problems along the day. It was measured with 3 items (e.g., *I often feel irritable after a day's work*).

Effort-Student-related issues refer to the amount of effort spent to help students develop their learning skills and adopt adequate behaviours. It was measured with 3 items (e.g., *I often have to do a lot for the students' learning issues*).

Reward-Emotional refers to self-esteem and recognition from superiors, colleagues, but especially from students, parents, and society. It was measured with 8 items (e.g., *I receive the respect I deserve from students' parents*).

Reward-Material refers to salary, career promotion opportunities and job security. It was measured with 6 items (e.g., *I have experienced, or I expect to experience, an undesirable change in my work situation*).

Over-commitment refers to teachers' personal coping characteristics to work demands that are defined by an excessive work-related involvement and the impossibility to develop a more distant attitude towards job requirements. It was measured with 6 items (e.g., *I am still thinking about work problems when I go to bed*).

2.2.2 Job Satisfaction

Teachers' job satisfaction was measured using 6 items taken and adapted from the TALIS survey (OECD, 2019), the PIRLS 2016 survey (Mullis et al., 2017) and from work of Skaalvik et al. (2011). The exploratory factor analysis (EFA) on these items was allowed due to the KMO index above the threshold value of .500 (.716) and the sphericity test was statistically significant. The EFA argued in favor of a single dimension. The first factor explained 45.8% of the variance and the item loadings on the factor were between .456 and .810. Omega coefficient for this scale was .725.

2.2.3 Impact of Work on Health

The impact of work on physical and mental health was measured using 4 items taken and adapted from the TALIS survey (OECD, 2019). The EFA on these items was allowed due to the KMO index above the threshold value of .500 (.839) and the sphericity test was statistically significant. The EFA argued in favor of a single dimension. The first factor explained 79.6% of the variance and the item loadings on the factor were between .742 and .922. Omega coefficient for this scale was .916.

2.2.4 Work-Life Balance

Work-life balance was measured via 4 items taken and adapted from TALIS (OECD, 2019) and the COPSOQ (Burr et al., 2019). The EFA on these items was allowed due to the KMO index above the threshold value of .500

(.805) and the sphericity test was statistically significant. The EFA argued in favor of a single dimension. The first factor explained 81.1% of the variance and the item loadings on the factor were between .823 and .911. Omega coefficient for this scale was .923.

2.3 Data Analyses

2.3.1 Preliminary Analyses

We first conducted preliminary EFA to examine the dimensionality of effort, reward, and over-commitment separately, as the factorial structure suggested by Ren et al. (2019) was not exactly in line with the ERI theory and because some of the items were slightly adapted to the Luxembourgish school context. Based on these preliminary results, we specified several rival measurement models.

2.3.2 Measurement Models

In a first step, the confirmatory factor analysis (CFA) is compared to the exploratory structural equation modeling (ESEM, Asparouhov, & Muthén, 2009) representation. In the usual independent cluster model confirmatory factor analysis, each item is defined by only one latent factor and cross-loadings are fixed at zero. Excluding cross-loadings can result in inflated factor correlations in CFA (Asparouhov et al., 2015; Morin et al., 2020) or in bifactor-CFA (Morin et al., 2016). In the ESEM, a target rotation is used to allow for the free estimation of cross-loadings between latent constructs and items. In comparison to CFA, ESEM gives more precise estimates of factor correlations (Asparouhov & Muthén, 2009; Morin et al., 2016). When the ESEM solution demonstrates well-defined factors with substantial target loadings, the factor correlations matrix is scrutinized. If noticeable decrease in the magnitudes of factor correlations is observed between the CFA and the ESEM representations, the latter model is retained due to its higher precision in estimations (Asparouhov et al., 2015). If decrease of factor correlations is not substantial, the principle of parsimony suggests giving preference to the CFA model. The continuum hypothesis of effort-reward imbalance could be partially supported if correlations between theoretically adjacent factors (i.e., over-commitment and effort scales, and effort scales and reward scales) are stronger than correlations between more distant ones (over-commitment and reward scales).

In a second step, the best fitting model between CFA and ESEM is compared to its bifactor counterpart (bifactor CFA or bifactor ESEM) to test the existence of an unmodeled general factor. In both bifactor-CFA (Reise, 2012) and bifactor-ESEM (Morin et al., 2016), a global factor accounts for the common variance among all items, while additional specific group factors explain the leftover variance beyond the global factor. In the bifactor CFA, it is postulated that general and specific factors are orthogonal, meaning they are unrelated while links between non-target factors and items are estimated in the bifactor ESEM.

To analyse data, the robust weighted least squares mean and variance adjusted (WLSMV) estimator as implemented in Mplus 8.3 (Muthén & Muthén, 2012-2019) was used to respect the ordinal level of measurement of Likert-type items. With the WLSMV estimator, missing values are handled using pairwise present. WLSMV has been found to outperform maximum-likelihood estimation methods for ordered-categorical items with asymmetric thresholds (Finney & DiStefano, 2006). The hierarchical nature of the data (teachers are nested in schools) has been considered using the Mplus design-based adjustment implemented by the TYPE=COMPLEX function.

2.3.3 Model Evaluation

The adequacy of all models was assessed using several indices (CFI, TLI, RMSEA, and SRMR) as well as typical interpretation guidelines (Hu & Bentler, 1999). CFI and TLI above .90 and .95 as well as RMSEA and SRMR below .08 and .06 were considered as reflecting adequate and excellent fit, respectively. The relative changes in CFI, TLI, RMSEA were examined to compare the nested measurement invariance models and a decrease of 0.010 or higher in CFI and TLI or an increase of 0.015 or higher in RMSEA was considered as indicating a lack of invariance or a lack of similarity (Cheung & Rensvold, 2002; Chen, 2007).

2.3.4 Reliability

To assess reliability, we reported the McDonald's model-based composite reliability (CR) index. CR values above 0.50 are considered as acceptable (Perreira et al., 2018). For bifactor models, we also computed the omega (ω) and omega hierarchical (ω_H) indices (Rodriguez et al., 2016). Omega represents the proportion of variability in the overall score explained by both the general factor (G-factor) and the specific factors (S-factors), while omega hierarchical gives the proportion of variance in the total score that can be attributed to the G-factor only. To determine that using a total score is justified, ω_H is divided by ω to get the Explained Common Variance (ECV). Using the total score is justified when ECV exceeds .75, as recommended by Reise et al. (2013).

2.3.5 Concurrent Validity

To examine the concurrent validity of the *Teacher ERIQ*, Pearson's product-moment correlations were computed with measures of perceived job satisfaction, negative impact of work on health, and work-life balance. Correlations were considered as small (0.10 - 0.30), medium (0.31 - 0.50), or large (above 0.50), as suggested by Cohen (1988).

3. Results

3.1 Preliminary EFA Analyses

We began by investigating the dimensionality of effort, reward, and over-commitment scales separately through EFA. The 4-factor solution for effort was not acceptable due to a negative residual variance for item EFF21, so we retained the 3-factor solution (F1=workload, F2=social responsibility, F3=emotional demands). For reward, a 3-factor solution also emerged (F1=esteem from parents and students, F2= esteem from professionals and society, F3=security/promotion). For over-commitment, the 1-factor solution was retained. Fit indices of each EFA solution are provided in the upper part of Table 2 while Table A1 in the appendix shows the detailed EFA results. For subsequent CFA analyses and to obtain a shorter questionnaire, we retained only 3 items per subdimension, all with EFA standardized factor loading above .400.

Table 2. Goodness-of-fit indices of measurement models

Models	Chi-square	df	CFI	TLI	RMSEA [90% CI]	SRMR
Exploratory purpose						
Effort – 1-factor EFA	575.064*	77	.913	.897	.079 [.073; .085]	.089
Effort – 2-factor EFA	343.907*	64	.951	.931	.065 [.059; .072]	.070
Effort – 3-factor EFA	140.888*	52	.985	.973	.041 [.033; .049]	.043
Reward – 1-factor EFA	563.585*	77	.831	.800	.078 [.072; .085]	.103
Reward – 2-factor EFA	202.694*	64	.952	.931	.046 [.039; .053]	.056
Reward – 3-factor EFA	141.576*	52	.969	.945	.041 [.033; .049]	.046
Overcommitment – 1-factor EFA	61.508*	9	.991	.985	.075 [.058; .094]	.044
Confirmatory purpose						
ICM-CFA	402.495*	168	.976	.970	.037 [.032; .041]	.044
ESEM	113.880	84	.997	.992	.019 [.008; .027]	.016
Bifactor ESEM	75.879	70	.999	.998	.009 [.000; .021]	.013

Note. * $p \leq .001$; df: degrees of freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; RMSEA: Root Mean Square Error of Approximation; CI: Confidence Interval; SRMR: Standardized Root Mean Squared Residual; E: effort; R: Reward; OC: Over-commitment.

3.2 Alternative Measurement Models

A suggested by the bifactor ESEM analysis framework, we began by testing the ICM-CFA and ESEM models with seven correlated factors (3 for effort, 3 for reward and 1 for over-commitment). Fit indices are provided in the lower part of Table 2 while factors correlations and standardized estimates for the CFA and ESEM solutions are reported in the appendix in Table A2 and Table A3 respectively. CFI, TLI, RMSEA and SRMR indices are excellent for both models. Factor correlations were however considerably reduced in the correlated factors ESEM solution (|r| = .004 to .654, M|r| = .311) relative to the correlated factors CFA solution (|r| = .090 to .773, M|r| = .502). The pattern of correlations partly supported the effort-reward imbalance continuum hypothesis, showing stronger correlations between adjacent over-commitment and effort scales (|r| = .569 to .773 and M|r| = .700 in the CFA solution and |r| = .432 to .654 and M|r| = .548 in the ESEM solution), moderate correlations between adjacent reward and effort scales (|r| = .009 to .750 and M|r| = .422 in the CFA solution and |r| = .004 to .382 and M|r| = .228 in the ESEM solution, and slightly lower correlations between over-commitment and reward scales (|r| = .236 to .547 and M|r| = .373 in the CFA solution and |r| = .172 to .285 and M|r| = .221 in the ESEM solution). The correlated factors ESEM were all well-defined (*Workload*: λ = .644 to .841, M_λ = .722; *Social responsibility*: λ = .539 to .949, M_λ = .683; *Emotional demands*: λ = .324 to .783, M_λ = .582; *Parents/Students*: λ = .514 to .833, M_λ = .722; *Professionals/Society*: λ = .468 to .641, M_λ = .526; *Security/Promotion*: λ = .327 to .457, M_λ = .399; *Over-commitment*: λ = .427 to .994, M_λ = .711). Thus, goodness-of-fit information, factor correlations, and target loadings converge in supporting the superiority of the ESEM solution.

The ESEM solution was contrasted with its bifactor counterpart, as 32 statistically significant cross-loadings (of which only 3 over .300) were observed. Fit indices for the bifactor ESEM solution (Table 2) were also excellent and slightly better than for the ESEM solution (ΔCFI = +.002; ΔTLI = +.006; ΔRMSEA = -.010; ΔSRMR = -.003). Standardized estimates for the bifactor ESEM solution are reported in Table 3. The general factor was globally well-defined (*General*: $|\lambda|$ = .199 to .718, $M_{|\lambda|}$ = .509) and specific factors were also relatively well-defined (*Workload*: λ = .529 to .623, M_λ = .562; *Social responsibility*: λ = .419 to .669, M_λ = .512; *Emotional demands*: λ = .223 to .462, M_λ = .354; *Parents/Students*: λ = .513 to .824, M_λ = .688; *Professionals/Society*: λ = .253 to .743, M_λ = .460; *Security/Promotion*: λ = .077 to .390, M_λ = .260; *Over-commitment*: λ = .228 to .756, M_λ = .481). In the bifactor ESEM solution, there were 39 statistically significant cross-loadings (of which 1 over .300). Therefore, it was decided to retain the bifactor ESEM model as the best representation of the data. This is of particular interest as the general factor provides a direct estimate of the effort-reward imbalance continuum. Globally, the item loadings on the general factor were high and positive for the items associated with the over-commitment S-factor (λ = .626 to .685, M_λ = .648) and the effort-emotional demands S-factor (λ = .568 to .718, M_λ = .655), positive but slightly lower for the effort-workload S-factor (λ = .523 to .651, M_λ = .573) and the effort-social responsibility S-factor (λ = .346 to .584, M_λ = .483), and negative for the reward S-factors (λ = -.199 to -.404, M_λ = -.290 for reward-Parents/Students, λ = -.271 to -.543, M_λ = -.414 for reward-Professionals/Society, and λ = -.320 to -.693, M_λ = -.499 for reward-Security/Promotion).

Reliability indicators are reported in Table 4. Most subscales had adequate levels (>.500) of McDonald's composite reliability (CR) except for the *Reward-Security/Promotion* S-factor (CR = .254). The omega and omega hierarchical indices of the total score were good (.940 and .830 respectively). It must be noted that 88.3% of the variance in the total score was explained by the G-factor, while 11.7% was due to the S-factors over and above the G-factor. These findings demonstrate that effort-reward imbalance as measured by the *Teacher ERIQ* is mainly underpinned by a global factor suggesting unidimensionality of the construct, even if well-defined specific factors exist beyond the general dimension.

Table 3. Standardized factor loadings (λ) and uniquenesses (δ) of the bifactor ESEM solution

	Items	**G** (λ)	**1** (λ)	**2** (λ)	**3** (λ)	**4** (λ)	**5** (λ)	**6** (λ)	**7** (λ)	δ
1. Effort-Workload	26	**.523****	**.534****	.066	.045	.152**	-.003	.117*	.141**	.378
	33	**.651****	**.623****	-.011	.021	.027	.109**	-.076	.037	.168
	23	**.545****	**.529****	.042	-.040	.076	-.003	.104*	.075*	.397
2. Effort-Social responsibility	2	**.521****	.064	**.669****	-.085	.143**	-.112**	-.026	-.067	.232
	17	**.584****	-.044	**.419****	-.047	.002	.064	.176**	.026	.443
	19	**.346****	.058	**.449****	.170**	.164**	.065	-.191	.033	.578
3. Effort-Emotional demands	34	**.718****	-.016	.011	**.379****	-.091**	-.002	.042	.120**	.317
	1	**.681****	.016	.007	**.462****	-.007	-.007	.072	.066	.313
	10	**.568****	.063	-.033	**.223****	-.089	.017	-.333**	.086	.496
4. Reward-Parents/ Students	24	**-.267****	.156**	.118**	-.032	**.824****	-.001	.069	-.016	.206
	27	**-.199****	-.083	.008	-.100*	**.727****	.229**	-.114	-.010	.349
	13	**-.404****	.135*	.130*	.082	**.513****	.213**	.051	.041	.482
5. Reward-Professionals/ Society	29	**-.429****	.033	-.079*	-.108**	.274**	**.743****	.098*	-.005	.160
	28	**-.543****	.030	.053	.187**	.229**	**.385****	-.104	.197**	.416
	14	**-.271****	.113	.078	.031	-.067	**.253****	-.091	.142**	.810
6. Reward-Security/ Promotion	4	**-.484****	.074	.021	-.061	.040	.002	**.313****	.116**	.643
	22	**-.693****	.177**	-.101**	.076	-.070	.140*	**.077**	.171**	.412
	16	**-.320****	.086	-.071	-.031	-.018	-.003	**.390****	-.057	.728
7. Over-commitment	31	**.626****	.065*	-.035	.075**	-.028	.060**	.031	**.756****	.021
	12	**.634****	.057	.034	.112**	.015	.093**	.047	**.459****	.359
	15	**.685****	.273**	-.035	-.057	.066*	.086*	-.078	**.228****	.381

Note. * $p \leq .05$; ** $p \leq .01$; ESEM: Exploratory Structural Equation Model. Target factor loadings are marked in bold.

Table 4. Reliability indicators for the Teacher ERIQ

		CR	ω	ω_H	ECV
Teacher ERIQ	G-factor	.932	.940	.830	.883
	S-1	.751	.860		
	S-2	.653	.781		
	S-3	.501	.816		
	S-4	.804	.829		
	S-5	.579	.714		
	S-6	.254	.615		
	S-7	.732	.732		

3.3 Concurrent Validity

Pearson's correlation between the factor scores derived from the bifactor ESEM solution and measures of job satisfaction, negative impact of work on health, and work-life balance are reported in Table 5. Remarkably, there were strong correlations between the ERI G-factor and indicators of impact of work on health (.709) and of work-life balance (r=-.694). In other words, teachers reporting high global effort-reward imbalance indices tend to also report higher indices of negative impact of work on their health and lower indices of work-life balance. The G-factor calculated from the *Teacher ERIQ* could be seen as a good predictor of both measures, supporting the concurrent validity of instrument which can been seen as mainly unidimensional. All other correlations were low or non-significant, except for those between the Reward-Parents/Students specific factor and the Job satisfaction measure (r=.348) and the Effort-Emotional demands specific factor and the negative impact of work on health indicator (r=.348). In other words, teachers reporting high acknowledgment form parents and students tend also to report higher job satisfaction, while teachers reporting higher negative emotional demand also tend to report higher negative impact of work on their health, controlling for the global ERI factor.

Table 5. Pearson's correlations between *Teacher ERIQ* factor scores and measures of job satisfaction, impact of work on health, and work-life balance

		Job satisfaction	Negative impact of work on health	Work-life balance
Teacher ERIQ	G	-.292**	.709**	-.694**
	S-1	.089**	.040	-.259**
	S-2	.094**	.052	-.041
	S-3	-.208**	.360**	-.234**
	S-4	.348**	-.122**	.014
	S-5	.240**	-.065	-.005
	S-6	.075*	-.044	-.030
	S-7	-.046	.113**	-.210**

Note. ** $p \leq .01$. * $p \leq .05$.

4. Discussion

The objective of the present study was to develop and validate a French version of the *Teacher ERIQ* (Ren et al., 2019) developed based on the ERI theory and questionnaire (Siegrist et al., 2004). EFA results first showed that effort and reward subdimensions obtained by Ren et al. (2019) were not confirmed with our data. While Ren et al. (2019) validated a structure of four factors of effort (workload, emotional demands, student-related issues, and social responsibility) and two factors of reward (emotional and material), the present study was not able to confirm nor the existence of the student-related effort factor, nor the distinction between emotional reward and material reward. Instead, we retained a 3-factor solution for effort (workload, social responsibility, and emotional demands) and a 3-factor solution for reward (esteem from parents and students, esteem from professionals and society, security/promotion of the job). For over-commitment, a 1-factor solution was retained. These results differ from previous factorial structures defined by Siegrist et al. (2014, 2019) or Rantanen et al. (2013) in the sense that some subscales of effort can also be distinguished.

The dimensionality of the instrument was further examined by using the bifactor-ESEM analysis framework and by testing several rival measurement models. The bifactor-ESEM solution was retained as the best factorial representation of the data with excellent adjustment fit indices. This led us to consider that effort-reward

imbalance (including over-commitment) as measured by the *Teacher ERIQ* could be seen essentially as a unidimensional construct while well-defined specific factors exist beyond that general dimension. Importantly, the analysis of the ESEM factor correlation matrix as well as the standardized factor loadings on the G-factor suggested the existence of a continuum that could be used instead of a posteriori calculating the classical ERI score. Factor loadings were high and positive for over-commitment and for effort-emotional demands, slightly less positive for the two other effort scales, and negative for the three reward factors.

The instrument showed good concurrent validity as significant correlations were observed between the ERI global factor score and other measures of job satisfaction, negative impact of work on health, and work-life balance. Some of the S-factors also showed statistically significant correlations with these three concurrent measures, suggesting that these S-factors could explain additional variance in the covariates over and above that already explained by the G-factor.

The *Teacher ERIQ* appears to be very useful to capture the unique psychosocial work environment experienced by teachers to explain stress-related health risks in this field, but also in the perspective of self-assessment and potential intervention purposes. Using the measure of effort-reward imbalance, educational policymakers can implement a monitoring of teachers' well-being and develop interventions to enhance it. These interventions might include prevention strategies, stress management programs, workload adjustments, specific recognition and reward systems, or regulations providing, for example, time for preparation and consultation between colleagues during the school day. The ERI measure for teachers can also guide the development of teacher training programs by focusing on the identification and adequate management of the stress factors.

5. Limitations and Conclusion

The present study has several limitations. The first one concerns the generalisability of our findings to all Luxembourgish elementary teachers because the sample is relatively huge but not strictly representative. Moreover, in this large-scale study, only 30% of the teachers have participated. This could be a problem if individuals who choose not to participate differ systematically from those who do participate, leading to limiting the generalizability of the findings. Even more importantly, teachers in Luxembourg enjoy a professional status that is very well rewarded in financial terms. It is plausible that our findings are not generalizable to elementary teachers in other education systems and further research is needed for confirmation or invalidation. Secondly, despite showing the superiority of the bifactor-ESEM representation of ERI data, we must acknowledge that the specific Reward Security/Promotion scale might benefit from further development as it has a poor reliability in our study. That said, at elementary schools in Luxembourg, it is rare for teachers to have to deal with physical safety issues when they are teaching. Similarly, items relating to job security or possible promotions also seem rather trivial, as teachers are appointed on a permanent basis and there is no progression, strictly speaking, other than salary progression linked to age. Maybe that further studies could examine the pertinence of such sub-dimension with teachers.

Despite these limitations, we believe that the strengths of the present study are obvious. For the first time, the bifactor-ESEM analysis framework has been applied to ERI data, showing potential benefits of such approach in term of dimensionality analysis, and calculation of global and specific factorial scores. Further research is nevertheless needed to confirm the existence of a continuum of effort-reward imbalance which could usefully replace the currently suggested ERI scores.

References

Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16*(3), 397-438. https://doi.org/10.1080/10705510903008204

Asparouhov, T., Muthen, B., & Morin, A. J. S. (2015). Bayesian Structural equation modeling with cross-loadings and residual covariances. *Journal of Management, 41*(6), 1561-1577. https://doi.org/10.1177/0149206315591075

Babamiri, M., Siegrist, J., & Zemestani, M. (2018). The factorial structure and psychometric properties of the Persian effort-Reward Imbalance questionnaire. *Safety and Health at Work, 9*, 334-338. https://doi.org/10.1016/j.shaw.2017.10.001

Bonifay, W., Lane, S. P., & Reise, S. P. (2017). Three concerns with applying a bifactor model as a structure of psychopathology. *Clinical Psychological Science, 5*(1), 184-186. https://doi.org/10.1177/2167702616657069

Burr, H., Berthelsen, H., Moncada, S., Nübling, M., Dupret, E., Demiral, Y., … Pohrt, A. (2019). The Third Version of the Copenhagen Psychosocial Questionnaire. *Safety and Health at Work, 10*(4), 482-503.

https://doi.org/10.1016/j.shaw.2019.10.002

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling 14*, 464-504. https://doi.org/10.1080/10705510701301834

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*, 233-255. https://doi.org/10.1207/S15328007SEM0902_5

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Oxfordshire: Erlbaum.

Finney, S. J., & DiStefano, C. (2006). Non-normal and categorical data in structural equation modeling. *Structural equation modeling: A second course, 10*(6), 269-314.

Hinz, A., Zenger, M., Brähler, E., Spitzer, S., Scheuch, K., & Seibt, R. (2016). Effort-reward imbalance and mental health problems in 1074 German teachers, compared with those in the general population. *Stress Health, 32*, 224-230. https://doi.org/10.1002/smi.2596

Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. https://doi.org/10.1080/10705519909540118

International Test Commission. (2017). *The ITC Guidelines for Translating and Adapting Tests* (2nd ed.).

Jolivet, A., Caroly, S., Ehlinger, V., Kelly-Irving, M., Delpierre, C., Balducci, F., ... & Lang, T. (2010). Linking hospital workers' organisational work environment to depressive symptoms: a mediating effect of effort–reward imbalance? The ORSOSA study. *Social science & medicine, 71*(3), 534-540. https://doi.org/10.1016/j.socscimed.2010.04.003

Lehr, D., Hillert, A., & Keller, S. (2009). What can balance the effort? Associations between effort-reward imbalance, overcommitment, and affective disorders in German teachers. *International journal of occupational and environmental health, 15*(4), 374-384. https://doi.org/10.1179/107735209799160509

Loerbroks, A., Meng, H., Chen, M. L., Herr, R., Angerer, P., & Li, J. (2014). Primary school teachers in China: associations of organizational justice and effort–reward imbalance with burnout and intentions to leave the profession in a cross-sectional sample. *International archives of occupational and environmental health, 87*, 695-703. https://doi.org/10.1007/s00420-013-0912-7

Morin, A. J. S. (2021). Exploratory structural equation modeling. In R. H. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (2nd ed.). Guilford.

Morin, A. J., Myers, N. D., & Lee, S. (2020). Modern factor analytic techniques: Bifactor models, exploratory structural equation modeling (ESEM), and bifactor–ESEM. *Handbook of sport psychology*, 1044-1073. https://doi.org/10.1002/9781119568124.ch51

Morin, A. J., Arens, A. K., & Marsh, H. W. (2016). A bifactor exploratory structural equation modeling framework for the identification of distinct sources of construct-relevant psychometric multidimensionality. *Structural Equation Modeling: A Multidisciplinary Journal, 23*(1), 116-139. https://doi.org/10.1080/10705511.2014.961800

Morin, A. J., Boudrias, J. S., Marsh, H. W., McInerney, D. M., Dagenais-Desmarais, V., Madore, I., & Litalien, D. (2017). Complementary variable-and person-centered approaches to the dimensionality of psychometric constructs: Application to psychological wellbeing at work. *Journal of Business and Psychology, 32*, 395-419. https://doi.org/10.1007/s10869-016-9448-7

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2017). *PIRLS 2016 International Results in Reading*. Pretoria: Centre for Evaluation and Assessment.

Muthén L. K., & Muthén B. O. (2012-2019). *Mplus user's guide: Statistical analysis with latent variables (8.3).* Los Angeles, CA: Muthén & Muthén.

Muthén, L. K., & Muthén, B. (2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Organisation for Economic Co-operation and Development (OECD). (2019). *TALIS 2018 Technical Report TALIS, OECD*. Retrieved from https://www.oecd.org/education/talis/TALIS_2018_Technical_Report.pdf

Preckel, D., Meinel, M., Kudielka, B. M., Haug, H.-J., & Fischer, J. E. (2007). Effort-reward-imbalance, overcommitment and self-reported health: Is it the interaction that matters? *Journal of Occupational and Organizational Psychology, 80*(1), 91-107. https://doi.org/10.1348/096317905X80183

Rantanen, J., Feldt, T., Hyvönen, K., Kinnunen, U., & Mäkikangas, A. (2013). Factorial validity of the

effort-reward imbalance scale: evidence from multi-sample and three-wave follow-up studies. Int Arch Occup Environ Health, 86(6), 645-656. https://doi.org/10.1007/s00420-012-0798-9

Reise, S. P., Bonifay, W. E., & Haviland, M. G. (2013). Scoring and modeling psychological measures in the presence of multidimensionality. *Journal of Personality Assessment, 95*, 129-140. https://doi.org/10.1080/00223891.2012.725437

Reise, S. P. (2012). The Rediscovery of Bifactor Measurement Models. *Multivariate Behavioral Research, 47*(5), 667-696. https://doi.org/10.1080/00273171.2012.715555

Ren, C., Li, X., Yao, X., Pi, Z., & Qi, S. (2019). Psychometric properties of the effort-reward imbalance questionnaire for teachers (teacher ERIQ). *Frontiers in psychology, 10*, 2047. https://doi.org/10.3389/fpsyg.2019.02047

Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Applying bifactor statistical indices in the evaluation of psychological measures. *Journal of personality assessment, 98*(3), 223-237. https://doi.org/10.1080/00223891.2015.1089249

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. The Gilford Press. https://doi.org/10.1521/978.14625/28806

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology, 1*(1), 27-41. https://doi.org/10.1037//1076-8998.1.1.27

Siegrist, J., & Li, J. (2016). Associations of extrinsic and intrinsic components of work stress with health: a systematic review of evidence on the effort-reward imbalance model. *International journal of environmental research and public health, 13*(4), 432. https://doi.org/10.3390/ijerph13040432

Siegrist, J., Li, J., & Montano, D. (2014, 2019). *Psychometric properties of the Effort-Reward Imbalance Questionnaire*. Retrieved from https://www.uniklinik-duesseldorf.de/fileadmin/Fuer-Patienten-und-Besucher/Kliniken-Zentren-Institute/Institute/Institut_fuer_Medizinische_Soziologie/Dateien/ERI/ERI_Psychometric-New.pdf

Siegrist, J., Starke, D., Chandola, T., Godin, I., Marmot, M., Niedhammer, I., & Peter, R. (2004). The measurement of effort–reward imbalance at work: European comparisons. *Social science & medicine, 58*(8), 1483-1499. https://doi.org/10.1016/S0277-9536(03)00351-4

Skaalvik, E. M., & Skaalvik, S. (2011). Teacher job satisfaction and motivation to leave the teaching profession: Relations with school context, feeling of belonging, and emotional exhaustion. *Teaching and Teacher Education, 27*, 1029-1038. https://doi.org/10.1016/j.tate.2011.04.001

Tsutsumi, A., Ishitake, T., Peter, R., Siegrist, J., & Matoba, T. (2001). The Japanese version of the Effort-Reward-Imbal- ance Questionnaire: A study in dental technicians. *Work and Stress, 15*, 86-96. https://doi.org/10.1080/02678370118173

Unterbrink, T., Zimmermann, L., Pfeifer, R., Wirsching, M., Brähler, E., & Bauer, J. (2008). Parameters influencing health variables in a sample of 949 German teachers. *International Archives of Occupational and Environmental Health, 82*, 117-123. https://doi.org/10.1007/s00420-008-0336-y

Useche, S. A., Alonso, F., Cendales, B., Montoro, L., & Llamazares, J. (2021). Measuring job stress in transportation workers: psychometric properties, convergent validity and reliability of the ERI and JCQ among professional drivers. *BMC Public Health, 21*(1), 1594. https://doi.org/10.1186/s12889-021-11575-1

Wang, Y., Ramos, A., Wu, H., Liu, L., Yang, X., Wang, J., & Wang, L. (2015). Relationship between occupational stress and burnout among Chinese teachers: a cross-sectional survey in Liaoning, China. *International archives of occupational and environmental health, 88*, 589-597. https://doi.org/10.1007/s00420-014-0987-9

Zurlo, M. C., Pes, D., & Siegrist, J. (2010). Validity and reliability of the effort-reward imbalance questionnaire in a sample of 673 Italian teachers. *International archives of occupational and environmental health, 83*, 665-674. https://doi.org/10.1007/s00420-010-0512-8

Appendix

Table A1. Items descriptive statistics and standardized factor loadings for the separate EFAs

	Items in French and original items in English	n	Frequency of responses						Geomin rotated loadings			Eigen value
			1	2	3	4	5	6	F1	F2	F3	
EFF26	J'ai souvent du travail à faire à la maison, en lien avec mon métier. **I often have to do work at home.**	955	.1	.7	2.7	8.9	27.2	60.3	**.805***	.019	-.006	5.508
EFF33	Mon travail empiète souvent sur mon temps libre. **My work often gets in the way of the spare time of my own.**	419	.7	3.3	9.3	16.0	31.0	39.6	**.801***	-.055	.131*	
EFF23	Pour préparer mes activités, je dois souvent travailler au-delà de mes heures contractuelles de travail. **I am often pressured to work overtime.**	418	.5	3.1	11.2	17.2	26.6	41.4	**.767***	.017	-.005	
EFF30	Je suis constamment pressé.e par le temps en raison de la lourde charge de travail. **I have constant time pressure due to a heavy work load.**	413	1.9	6.1	15.5	24.2	27.6	24.7	**.473***	.015	**.402***	
EFF21	Je dois souvent faire beaucoup pour répondre aux problèmes d'apprentissage des élèves. **I often have to do a lot for the students' learning issues.**	950	.1	1.2	3.8	14.5	35.9	44.5	.322*	.210*	.226*	
EFF2	Par rapport aux autres professions, la société a de grandes exigences envers les enseignants. **Compared with other professions, society puts high demands on teachers in all aspects.**	408	.0	.5	4.2	15.0	37.7	42.6	-.010	**.828***	.008	1.438
EFF17	La société a trop d'attentes envers les enseignants. **Society has excessive expectations on teachers.**	934	.3	1.4	5.9	16.8	35.7	39.9	-.003	**.555***	.245*	
EFF19	Par rapport à d'autres professions, les enseignants ont plus de responsabilités. **Compared with other professions, teachers have more responsibility.**	390	.5	3.1	7.7	23.3	34.6	30.8	.040	**.536***	.049	
EFF8	J'ai beaucoup de responsabilités dans mon travail. **I have a lot of responsibility in my job.**	959	.0	.1	.2	6.0	28.8	64.9	.288*	.381*	-.107	
EFF5	Le fait que les parents s'impliquent peu dans la scolarité de leur enfant rend mon travail encore plus difficile. **The missing of family education makes my work even more difficult.**	410	1.0	4.9	8.8	20.5	27.3	37.6	.113	.224*	.035	
EFF34	Je me sens souvent irritable après une journée de travail. **I often feel irritable after a day's work.**	935	2.8	8.8	20.6	24.2	23.6	20.0	-.005	.036	**.811***	1.203
EFF1	Je me sens épuisé.e après une journée de travail. **I feel exhausted after a day's work.**	957	.9	3.9	9.5	25.8	29.2	30.7	.070	.021	**.755***	
EFF10	J'ai tellement de soucis dans mon travail que je parais plus vieux.vieille que mes pairs du même âge. **Too many things in work make me look older than peers.**	371	22.4	28.3	24.5	10.8	8.4	5.7	.127	-.062	**.573***	
EFF6	Je me sens libre de prendre avec mes élèves les mesures disciplinaires que je trouve nécessaires. **I feel restrained when discipling students.**	405	6.4	8.1	16.3	29.1	29.4	10.6	-.092	-.069	**.507***	
REW24	Les élèves me respectent à ma juste valeur. **I receive the respect I deserve from students.**	420	1.0	2.1	8.3	21.4	45.7	21.4	**.926***	-.240*	.003	4.161
REW27	Les élèves sont reconnaissants de mes efforts. **Students are grateful to my efforts.**	915	2.3	4.4	12.0	29.9	37.6	13.8	**.829***	-.005	-.238*	
REW13	Les parents de mes élèves me respectent à ma juste valeur. **I receive the respect I deserve from students' parents.**	412	1.7	4.4	8.3	37.9	37.6	10.2	**.617***	.101	.084	
REW32	Je pense que mon métier a de la valeur. **I think my job is valuable.**	954	.7	2.2	6.0	8.7	38.6	43.8	**.411***	.140*	-.128*	

REW29	Mes efforts professionnels sont reconnus. **Considering my efforts, my professional title is adequate.**	922	3.0	7.3	20.3	34.8	29.8	4.8	**.429***	**.540***	.000	1.770
REW28	La société me respecte à ma juste valeur. **I receive the respect I deserve from the society.**	392	8.9	20.7	25.8	27.8	14.0	2.8	.325*	**.422***	.123	
REW14	Je pense que je pourrais bénéficier d'une aide appropriée si je devais un jour faire face à un problème au travail. **I'd have access to suitable help when confronting difficulties at work.**	363	9.4	14.3	23.1	21.2	23.1	8.8	-.013	**.412***	.071	
REW11	Dans mon école, j'ai le sentiment d'être respecté.e à ma juste valeur. **I receive the respect I deserve from the school.**	947	.7	3.2	4.5	19.7	40.9	30.9	.314*	.391*	-.042	
REW7	Compte tenu de mon engagement, mon salaire est suffisant. **Considering my efforts, my salary is adequate.**	922	3.7	7.8	10.4	17.2	35.7	25.2	.132*	.199*	.040	
REW4	Il y a des risques pour la sécurité dans cette profession. **My work is threatened by safety hazards.**	899	6.1	16.1	21.1	21.5	23.2	11.9	.093	-.015	**.546***	1.107
REW22	Le gouvernement ne protège pas suffisamment les enseignants. **The government has insufficient protections on teachers.**	383	.8	3.7	10.7	21.1	29.8	33.9	.008	.339*	**.519***	
REW16	J'ai déjà subi ou je m'attends à subir un changement non souhaité dans ma situation professionnelle. **I have experienced or I expect to experience an undesirable change in my work situation.**	359	16.4	21.7	17.3	13.1	20.9	10.6	-.017	.000	**.503***	
REW3	Mes opportunités de promotion à titre professionnel sont rares. **My promotion opportunities of professional title are rare.**	277	1.8	5.8	12.6	21.7	36.1	22.0	.044	.091	**.427***	
REW18	J'ai déjà été traité.e injustement au travail. **I was treated unfairly at work.**	405	8.1	17.5	16.5	17.5	24.0	16.3	-.027	.311*	.365*	
OVER31	Je pense encore aux problèmes professionnels lorsque je vais me coucher. **I am still thinking about work problems when I go to bed.**	951	2.6	7.7	13.5	23.7	25.8	26.8	**.897***	—	—	3.632
OVER12	Je commence à penser aux problèmes du travail dès que je me lève le matin. **I start thinking about work problems as soon as I get up in the morning.**	950	4.2	12.0	17.3	22.6	22.7	21.2	**.824***	—	—	
OVER9	Quand je rentre à la maison, je peux facilement me détendre et me déconnecter du travail. **When I get home, I can easily relax and ''switch off'' work.**	961	27.9	22.3	23.6	15.5	8.0	2.7	**.744***	—	—	
OVER15	Mes proches me disent que je sacrifie trop de choses pour mon travail. **People close to me say I sacrifice too much for my job.**	927	4.4	11.5	15.9	18.9	23.8	25.5	**.716***	—	—	
OVER25	Si je reporte au lendemain une tâche que je devais faire le jour même, j'ai du mal à dormir. **If I postpone something that I was supposed to do today I'll have trouble sleeping at night.**	418	9.1	13.6	13.6	16.0	24.4	23.2	**.648***	—	—	
OVER20	Je suis facilement dépassé.e par les contraintes de temps au travail. **I get easily overwhelmed by time pressures at work.**	395	4.6	16.2	25.8	24.1	18.0	11.4	**.513***	—	—	

Note. 1=Totally disagree, 2=Disagree, 3=Rather disagree, 4=Rather agree, 5=Agree, 6=Totally agree; * $p \leq .05$.

Table A2. Latent Correlations for the Correlated Factors in ICM-CFA (under the diagonal) and Correlated Factors in ESEM (above the diagonal)

Teacher ERIQ dimensions	1	2	3	4	5	6	7
1. Effort-Workload	—	.439**	.446**	-.045	-.187**	-.209**	.558**
2. Effort-Social responsability	.558**	—	.495**	-.004	-.348**	-.304**	.432**
3. Effort-Emotional demands	.636**	.611**	—	-.286**	-.294**	-.382**	.654**
4. Reward-Parents/Students	-.110	-.090	-.400**	—	.389**	.197**	-.206**
5. Reward-Professionals/Society	-.335**	-.414**	-.558**	.707**	—	.215**	-.172**
6. Reward-Security/Promotion	-.471**	-.678**	-.750**	.333**	.678**	—	-.285**
7. Over-commitment	.758**	.569**	.773**	-.236**	-.338**	-.547**	—

Table A3. Standardized Factor Loadings (λ) and Uniquenesses (δ) of the Correlated Factors CFA and ESEM Solutions for the 7-factor models

		CFA		ESEM							
	Items	λ	δ	**1** (λ)	**2** (λ)	**3** (λ)	**4** (λ)	**5** (λ)	**6** (λ)	**7** (λ)	δ
	EFF26	.771**	.406	**.644****	.053	.092	.100*	-.063	.132**	.129**	.379
1. Effort-Workload	EFF33	.895**	.199	**.841****	.012	.073	-.065	.073	-.118**	.005	.168
	EFF23	.751**	.436	**.683****	.063	-.002	.016	-.090	.074	.095	.396
	EFF2	.749**	.438	.036	**.949****	-.135**	.002	-.047	-.023	-.049	.171
2. Effort-Social responsibility	EFF17	.773**	.403	-.011	**.563****	.045	-.045	-.039	.031	.164**	.534
	EFF19	.557**	.690	.008	**.539****	.170**	.060	.218**	-.114	-.054	.615
	EFF34	.839**	.297	.024	.047	**.639****	-.071*	-.053	-.016	.141**	.321
3. Effort-Emotional demands	EFF1	.784**	.386	.062	.010	**.783****	.030	-.065	.032	.017	.310
	EFF10	.662**	.562	.129*	-.010	**.324****	-.120*	.079	-.348**	.092	.518
	REW24	.759**	.425	.109**	.037	-.015	**.819****	-.070	.097*	-.082	.292
4. Reward-Parents/Students	REW27	.750**	.437	-.111**	-.057	-.089	**.833****	.052	-.250**	.119*	.278
	REW13	.793**	.371	.051	.049	.055	**.514****	.260**	.184**	-.126*	.471
	REW29	.775**	.399	.015	-.065	-.154**	.279**	**.469****	.043	.027	.472
5. Reward-Professionals/Society	REW28	.727**	.471	-.130**	-.039	.066	.173**	**.641****	.102	-.009	.385
	REW14	.313**	.902	.042	.068	-.136	-.159**	**.468****	.046	.018	.797
	REW4	.538**	.710	-.054	-.035	-.199**	.047	.045	**.457****	.058	.638
6. Reward-Security/Promotion	REW22	.767**	.411	.038	-.233**	-.129	-.102*	.381**	**.327****	-.067	.442
	REW16	.399**	.841	.064	-.108	-.043	.015	-.080	**.413****	-.104	.756
	OVER31	.858**	.263	-.047	-.030	.017	-.041	.041	.072*	**.994****	.092
7. Over-commitment	OVER12	.844**	.288	-.016	.080*	.128**	.007	.024	.036	**.713****	.334
	OVER15	.777**	.397	.384**	.015	-.023	.030	-.031	-.188**	**.427****	.382

Note. * $p \leq .05$; ** $p \leq .01$; CFA: Confirmatory Factor Analysis. ESEM: Exploratory Structural Equation Model. Target factor loadings are marked in bold.

Acknowledgments

We would like to thank all the teachers who took the time to participate in this study.

Funding

This work was supported by the Observatoire de l'Enfance, de la Jeunesse et de la Qualité Scolaire in Luxembourg (OEJQS).

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.