

The Influencing Factors of Teachers' Job Satisfaction and its Influence on Instructional Practices: Evidence from Korea TIMSS 2019

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Abstract

This paper investigates the factors influencing teachers' job satisfaction and its relationship with instructional practices. Grounded in the Job Demands–Resources Theory, the study employs partial least squares structural equation modeling to analyze data from 463 eighth-grade mathematics and science teachers using eTIMSS 2019 data from Korea. Job demands include challenges faced by teachers and those posed by students. Job resources encompass the school's emphasis on academic success (from both teachers' and others' perspectives), the school environment (including school safety, student behavior, and school rules), and professional development (both past and anticipated). The dependent variables are teachers' job satisfaction and their instructional practices.

The study finds that emphasis on academic success, school safety, student behavior, and past professional development are positively associated with higher job satisfaction. Additionally, there is a significant correlation between teachers' instructional practices and their job satisfaction. Although student-related challenges such as disruptive behavior and lack of interest do not directly impact job satisfaction, teachers express concern about these issues. The findings underscore the importance of factors that enhance both teachers' job satisfaction and instructional practices. By identifying key elements that contribute to satisfaction, this research provides insights to inform policy and practice in educational settings. Theoretical and practical implications are discussed, emphasizing the need for supportive school environments and professional development opportunities to sustain high levels of teacher satisfaction.

Keywords: Job satisfaction, Instructional practice, TIMSS, Secondary school teacher

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Introduction

The global teacher shortage remains a pressing concern in numerous countries (Burke & Ceo-DiFrancesco, 2022; Castro, 2023; Love & Love, 2022). Beyond the imperative of training and recruiting new teachers, retaining existing teachers within the profession holds equal significance. A primary catalyst for teacher resignations stems from dissatisfaction with their roles (Federičová, 2020; Wyatt & O'Neill, 2021). Furthermore, the extensively noted correlation between teachers' job satisfaction and their overall life contentment is well-documented (Capone et al., 2022; Chamani et al., 2023; Luque-Reca et al., 2022). Additionally, their satisfaction level significantly impacts student achievement (Arens & Morin, 2016; Collie & Martin, 2017; Hoque et al., 2023). Therefore, gaining an in-depth comprehension of the determinants of teachers' job satisfaction stands as a pivotal strategy for sustaining educators within the system.

Job satisfaction comprises a complex blend of multifaceted factors. Early definitions highlighted a combination of psychological, physiological, and environmental circumstances (Hoppock, 1935), while later interpretations emphasized the emotional spectrum—from positive to negative sentiments—toward work (Karatepe et al., 2006). As a result, numerous studies have explored this multifaceted attribute from various perspectives (Admiraal & Kittelsen Røberg, 2023; Madigan & Kim, 2021; Pozas et al., 2023). Moreover, large-scale international surveys like the Teaching and Learning International Survey (TALIS) 2018 have been specifically designed to unravel teachers' circumstances, including their job satisfaction (Organisation for Economic Co-operation and Development [OECD], 2019). However, the majority of the studies (e.g., Niu et al., 2023; Toropova et al., 2020) predominantly evaluate factors centered on teachers, encompassing job-related or school-related aspects, which might not be comprehensive. Considering that students' achievement depends on teachers' characteristics (Đerić et al., 2022), an exploration of factors entwined with both dimensions becomes paramount. Factors influencing students' achievement could simultaneously affect teachers' job satisfaction. Furthermore, while teachers' job satisfaction has consistently been shown to influence students' success (Hoque et al., 2023; Wartenberg et al., 2023), the intricate link between teachers' job satisfaction and its impact on students' achievements remains inadequately explored. Therefore, this study aims to investigate the impact of student-related factors on teachers' job satisfaction and consequently on their instructional practices.

Objectives

This study delved into teachers' job satisfaction with a specific emphasis on factors intertwined with students' achievement according to the TIMSS 2019 framework (Mullis & Martin, 2017). Furthermore, it postulated a correlation between teachers' job satisfaction and their instructional practices as a possible explanation for a connection between teachers' job satisfaction and students' academic achievement. Specifically, this study tested the hypothesis of relationships between various teachers' student-related factors on their job satisfaction and its following effect on instructional practices. The findings of this study aimed to unveil indicators of teachers' job satisfaction that

concurrently support students' achievements. The insights provided by this study not only elucidate the impact of teachers' satisfaction on students' achievement but also empower policymakers and school administrators to design and implement policies that serve the mutual benefit of both teachers and students. This study was guided by the following research questions:

RQ1. What is the extent of the significance of some of the TIMSS 2019 factors in predicting teachers' job satisfaction?

RQ2. Does teachers' job satisfaction significantly influence their instructional practices?

Conceptual Framework

1. Job satisfaction theory

Herzberg's two-factor theory, also known as the motivation-hygiene theory, provides a foundational framework for understanding job satisfaction (Herzberg et al., 1959). According to Herzberg, job satisfaction arises from motivators, such as recognition, achievement, and growth opportunities, while dissatisfaction stems from hygiene factors, such as salary, work conditions, and organizational policies (Herzberg et al., 1959). For educators, this theory underscores the importance of addressing both intrinsic motivators and extrinsic hygiene factors to enhance teachers' job satisfaction (Shi et al., 2024; Sunzhong et al., 2022). However, this theory treats satisfaction and dissatisfaction separately which causes controversial in some contexts (Lee et al., 2022). Therefore, this study utilizes the Job Demands-Resources Theory (JD-R) which focuses on the negative (demands) and positive (resources) factors on job satisfaction.

JD-R is a widely used framework in organizational psychology that explains how job characteristics affect employee well-being and performance (Bakker & Demerouti, 2007). The theory posits that every job has two types of characteristics: job demands and job resources. Job demands refer to the physical, psychological, social, or organizational aspects of a job that require effort and can potentially lead to exhaustion or stress (Bakker & Demerouti, 2014). Job resources, on the other hand, are the aspects of a job that help employees achieve their work goals, reduce job demands, and stimulate personal growth and development (Bakker & Demerouti, 2014). This theory aligns with the definition of job satisfaction by Evans (1997) who defined this term as "a state of mind determined by the extent to which the individual perceives her/his job-related needs to be met" (p. 328). Specifically, job demands and job resources affect teachers' perceptions and consequently influence their job satisfaction (Bakker & Demerouti, 2007; Demerouti et al., 2001; Demerouti & Bakker, 2011; Liang, 2023).

In the context of teaching, research has shown that the JD-R theory is a useful framework for understanding teachers' job satisfaction (Granziera et al., 2020; Han et al., 2019; Liang, 2023). Examples of job demands and job resources for teachers are high workloads and professional development opportunities, respectively (Granziera et al., 2020). Additionally, several studies utilized this theory to investigate teachers' job satisfaction. For instance, Han et al. (2019) tested the JD-R theory on university teachers in mainland China and found that job demands reduced job satisfaction through emotional exhaustion, while job resources increased job satisfaction through work engagement. Moreover, Liang (2023) analyzed Shanghai TALIS 2018 and found that job demands negatively influence teachers' job satisfaction while job resources' effect is the opposite.

2. Teachers' job satisfaction and their instructional practices

Although numerous studies have demonstrated that teachers' job satisfaction significantly impacts students' academic achievement (Caprara et al., 2006; Dicke et al., 2020; Wartenberg et al., 2023), the comprehension of the underlying mechanism remains limited. Given that the manner in which teachers convey content to students is a crucial factor for students' achievement, instructional practices emerge as a potential candidate to elucidate this relationship. Research has shown that job satisfaction is positively related to teacher self-efficacy, which in turn influences instructional behavior (Burić & Moè, 2020; Nguyen et al., 2019). In a study by Burić & Moè (2020), it was found that teachers with higher self-efficacy beliefs reported increased job satisfaction, organizational commitment, motivation, and job involvement. Additionally, job satisfaction has been linked to positive affect and well-being factors, such as positive emotions, which can shape teachers' enthusiasm for teaching (Burić & Moè, 2020; Chaman, 2020). Moreover, the impact of teachers' job satisfaction on their instructional strategies has been examined in various contexts. For instance, Kafipour and Noordin (2020) investigated the relationship between EFL teachers' job satisfaction and their extroversion/introversion traits, finding that introverted teachers were more satisfied. However, the study did not find a significant correlation between job satisfaction and teachers' instructional strategy use. In conclusion, job satisfaction holds the potential to exert an influence on teachers' instructional practices. Nevertheless, the empirical evidence in support of this assertion is rather limited.

3. Trends in International Mathematics and Science Study 2019

The Trends in International Mathematics and Science Study (TIMSS) 2019, conducted by the International Association for the Evaluation of Educational Achievement (IEA), provided an extensive evaluation of fourth- and eighth-grade students' performance in mathematics and science across diverse countries (Mullis et al., 2020). Beyond mere academic assessment, TIMSS has developed comprehensive context questionnaires aimed at students, teachers, and school principals (Mullis & Martin, 2017). The framework behind these questionnaires aimed to delve into five crucial domains, encompassing community and national policies, home context, school context, classroom environments, and student attitudes toward learning (Mullis & Martin, 2017).

In the TIMSS 2019 teacher questionnaire, data was gathered aligned with the previously mentioned five key domains aimed at bolstering student achievement. Teachers provided information encompassing demographic details, the school's emphasis on academic success, the school environment, job satisfaction, challenges in their roles,

reference class data, and professional development. Challenges from students and teachers' instructional practices are examples of reference class data. While many questions aligned for both mathematics and science teacher questionnaires, there were variations, particularly in subject-specific inquiries. For instance, the science teacher questionnaire emphasized scientific process skills, whereas the mathematics teacher questionnaire focused on problem-solving abilities within the reference class. Another difference is the professional development information, where both questionnaires focused on their own subjects' competence.

Although designed with the main goal of understanding factors influencing student achievement, these factors relate directly to teachers' responsibilities and their working conditions. The potential to maximize student achievement, a core objective for teachers, hinges heavily on these factors, which in turn influence their level of satisfaction. This dataset provided substantial information and enabled a nuanced examination of how these elements influence teachers' job satisfaction and subsequently shape their teaching practices.

This study, based on the JD-R theory, thoroughly investigated how student-oriented factors influence teachers' job satisfaction, which in turn is correlated with their instructional practices as illustrated in Fig. 1. The research focused on eighth-grade mathematics and science teachers in the Republic of Korea, renowned for its excellent educational system and outstanding student achievements in assessments like TIMSS and PISA. By leveraging the extensive TIMSS 2019 survey data (Fishbein et al., 2021), this study explored various variables categorized into job demands and resources, in consultation with the JD-R theory. The former encompasses teachers' perceptions of the school's emphasis on academic success (EAS), the school environment (ENV), and professional development (PD), while the latter comprises teachers' challenges (CT) and challenges arising from students (CS). Two dependent variables are teachers' job satisfaction (JS) and their instructional practices (IP). Notably, some variables can be further categorized, such as EAS, which consists of teacher-centric aspects (EAS_T) and external aspects (EAS_O), ENV, which includes school safety (ENV_Sc), student behavior (ENV_St), and school rules (ENV_R), and PD, which includes past professional development (PDP) and anticipated professional development (PDF). Fig. 2 presents the comprehensive model employed in this study.

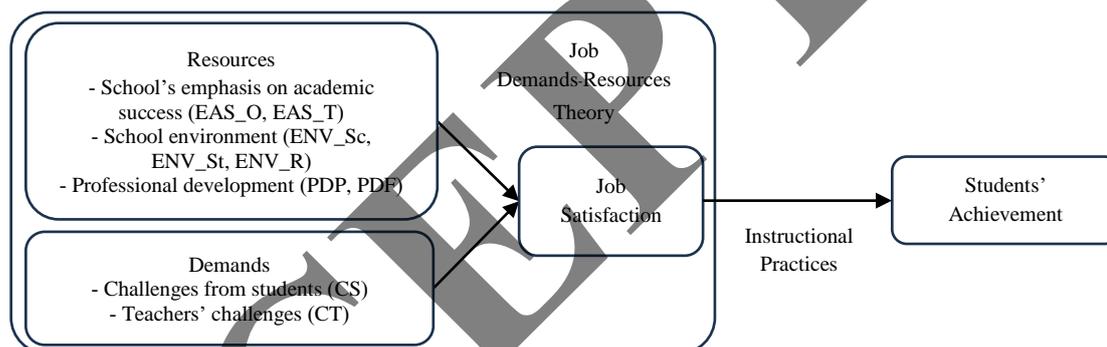


Figure 1 Conceptual Framework

4. Hypotheses

Challenges represent an inherent aspect of any workplace and exert a substantial impact on job satisfaction across professions (Li et al., 2023; Mota et al., 2023; Qiong & Yao, 2021). Within the context of the TIMSS 2019 survey, two perspectives of teachers' challenges were considered: challenges regarding their responsibilities as teachers (CT) and challenges originating from students (CS). The aspects that CT evaluated include in-classroom teaching-related, out-of-the-classroom teaching-related, and administrative tasks. In CS, it assessed teachers' perceptions of their working environment related to students including academic, health-related, behavioral, and mental aspects. These factors align with job demands because they require teachers to put more effort into dealing with these issues which could lead to more stress. An in-depth analysis of these distinct aspects can offer invaluable insights into supporting teachers' job satisfaction.

H1. Challenges stemming from students (CS) significantly influence teachers' job satisfaction (JS).

H2. Challenges related to teachers' responsibilities (CT) significantly influence teachers' job satisfaction (JS).

The evaluation of a school's emphasis on academic success (EAS) involves assessing stakeholders' contributions to student achievement. This study categorized this construct into two key facets: teachers' aspects (EAS_T) and other contributors' aspects (EAS_O). Within the teacher context, EAS_T reflected educators' understanding of the school's curriculum, expectations for effective curriculum implementation and student accomplishment, and ability to inspire students. Competent teachers possess job resources that support them to finish tasks more easily. Conversely, EAS_O evaluated teachers' perceptions regarding the efforts of other stakeholders in enhancing academic achievement. Specifically, this construct focuses on cooperation from students and parents to support students' learning. An example of an item in this construct is asking teachers to characterize "Parental commitment to ensure that students are ready to learn" from very low to very high. In the Korean context, the study reveals that supporting colleagues and principal impacts teachers' job satisfaction (You et al., 2015). Research consistently demonstrated a positive correlation between this emphasis and student achievement (Atar, 2014; Martin et al., 2013). Furthermore, prior studies underscored that teachers' perceptions of a school's emphasis on academic success significantly influence their job satisfaction (Ker et al., 2022).

H3. Teachers' aspects of a school's emphasis on academic success (EAS_T) significantly influence teachers' job satisfaction (JS).

H4. Others' aspects of a school's emphasis on academic success (EAS_O) significantly influence teachers' job satisfaction (JS).

The workplace environment emerges as a pivotal predictor of job satisfaction across professions (Ning et al., 2022; Probst et al., 2010). In the OECD's TALIS, school environment is defined as part of teacher job satisfaction (Organisation for Economic Co-operation and Development [OECD], 2014). Within the TIMSS 2019 survey, the school environment (ENV) encompasses aspects such as school safety (ENV_Sc), student behavior (ENV_St), and rules (ENV_R). Studies suggested correlations between school safety and rules with students' achievement (Martin et al., 2013). Furthermore, another study found that positive student behavior and conducive working conditions significantly affect teachers' job satisfaction (Ortan et al., 2021). Therefore, working in a supportive environment allows teachers to focus on their work which lessens their efforts.

H5. School safety (ENV_Sc) significantly influences teachers' job satisfaction (JS).

H6. Student behavior (ENV_St) significantly influences teachers' job satisfaction (JS).

H7. Rules within the school (ENV_R) significantly influence teachers' job satisfaction (JS).

Teachers play a pivotal role as vital intermediaries between national policies and students' academic achievements, often immersing themselves in ongoing professional development endeavors to align with evolving requirements (Pak et al., 2020). The TIMSS 2019 survey encompassed an assessment of both prior participation in professional development within the past two years (PDP) and the anticipation of future professional development needs (PDF). These professional developments lead to changes in teachers' practices which could consequently benefit students and schools (Opfer & Pedder, 2010). Hence, this construct should support teachers more effectively and productively. Extensive research underscored a significant correlation between PDP and job satisfaction (JS) (Kang & Mavrogordato, 2023; Niu et al., 2023). Additionally, Niu et al. (2023) demonstrated that PDF also exerts a considerable influence on JS in the Korean and Japanese context.

H8. The need for future professional development (PDF) significantly influences teachers' job satisfaction (JS).

H9. Participation in professional development in the past two years (PDP) significantly influences teachers' job satisfaction (JS).

Teachers are one of the key factors in maximizing students' achievement, a relationship consistently corroborated by studies highlighting the positive impact of teachers' job satisfaction on students' success (Arens & Morin, 2016; Collie & Martin, 2017; Hoque et al., 2023). Furthermore, empirical evidence underscored that teachers' instructional practices significantly influence students' academic achievements (Bartholomew et al., 2018). Moreover, the analysis of TALIS 2018 data reveals the relationship between teachers' job satisfaction and instructional quality (Harrison et al., 2023). These findings suggested a possible connection between teachers' job satisfaction (JS) and their instructional practices (IP). Hence, this study proposes the hypothesis that JS positively influences IP.

H10. Teachers' job satisfaction (JS) significantly influences their instructional practices (IP).

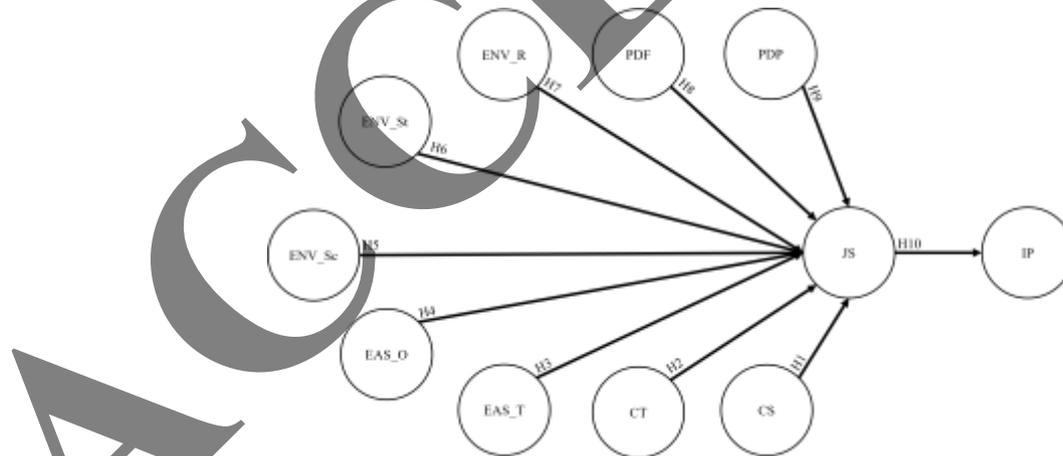


Figure 2 The model used in this study

Research Methodology

1. Participants and Data Collection

This study drew upon data sourced from the teacher questionnaire of the TIMSS 2019 survey (Fishbein et al., 2021). 64 countries participated in the TIMSS 2019 survey (Mullis et al., 2020). Participating countries were given the option to administer either paperTIMSS (paper-based) or eTIMSS (computer- and tablet-based) modes (Martin et al., 2020). For TIMSS 2019, a two-stage random sample design was utilized to obtain sample schools and classes (Martin et al., 2020) and teachers of those classes responded to the teacher questionnaire (Mullis et al., 2020). A comprehensive delineation of instrument development, sampling procedures, data collection methodologies, analysis techniques, and report preparation specifics is available in the TIMSS 2019 technical report (Martin et al., 2020). Specifically, this study focused on a meticulous analysis of data obtained from eighth-grade mathematics and science teachers in Korea. This

targeted approach aimed to minimize potential confounding variables, ensuring a precise examination within a specific grade and country context. Notably, the data collection mode adopted in Korea was eTIMSS.

The questionnaire employed diverse scale types: a 3-Likert scale for CS, a 4-Likert scale for ENV, CT, JS, and IP, and a 5-Likert scale for EAS. Lower scale values signify higher levels of agreement or frequency for all items. PDP and PDF were the only constructs featuring binary response items (yes/no). It is worth noting that the wording of items and variable names for PDP and PDF slightly varied between the mathematics and science teacher questionnaires. Specifically, variable names for mathematics and science were denoted as BTBM22 and BTBS21, respectively. Additionally, minor linguistic adjustments were made to maintain consistency between the mathematics and science teacher questionnaires. For instance, the term “math” in the mathematics teacher questionnaire was replaced with “science” in the science teacher questionnaire. Supplement 1 of the user guide encompasses a comprehensive compilation of variable names and questionnaires (Mullis et al., 2020). The total sample size for this study consists of 463 participants (N = 463). To address very small numbers of missing data points (the maximum percentage of each item missing values is 2.6%), median imputation was applied because every variable is categorical. Refer to Table 1 for a detailed presentation of the demographic breakdown within this sample.

Table 1 Demographic data

Variable	Value	Number	Percentage (%)
Gender	Female	329	71.1
	Male	134	28.9
Subject	Math	228	49.2
	Science	235	50.8
Age	Under 25	4	0.9
	25–29	49	10.6
	30–39	132	28.5
	40–49	146	31.5
	50–59	121	26.1
	60 or more	11	2.4
Education level	Bachelor’s or equivalent level	287	62.0
	Master’s or equivalent level	172	37.1
	Doctor or equivalent level	4	0.9
Experience	Less than 5 years	90	19.4
	5 - 15 years	153	33.1
	16 - 25 years	100	21.6
	More than 25 years	119	25.7
	Missing	1	0.2

2. Research Instrument

As previously mentioned, this study derived eleven constructs from the TIMSS 2019 survey. The items falling under question 6, titled ‘School Emphasis on Academic Success,’ were utilized for the EAS construct. Despite sharing the same heading, the items within this question can be classified into those pertaining to teachers (BTBG06A, BTBG06B, BTBG06C, BTBG06D, and BTBG06L), parents (BTBG06E, BTBG06F, BTBG06G, and BTBG06H), and students (BTBG06I, BTBG06J, and BTBG06K). Specifically, the teacher-related items were employed for the EAS_T construct, while the remaining two categories were allocated to the EAS_O construct. Question 7 focused on assessing the school environment (ENV). The items in this section targeted school safety (BTBG07A, BTBG07B, and BTBG07C), student behavior (BTBG07D, BTBG07E, and BTBG07F), and school rules implementation (BTBG07G and BTBG07H), corresponding to ENV_Sc, ENV_St, and ENV_R, respectively. Job satisfaction (JS) and teachers’ challenges (CT) were formulated using items from question 8 (BTBG08A, BTBG08B, BTBG08C, BTBG08D, and BTBG08E) and question 9 (BTBG09A, BTBG09B, BTBG09C, BTBG09D, BTBG09E, BTBG09F, BTBG09G, and BTBG09H), respectively. Furthermore, reference class data included questions such as question 12, which collected information on teachers’ instructional practices (IP) through seven items (BTBG12A, BTBG12B, BTBG12C, BTBG12D, BTBG12E, BTBG12F, and BTBG12G) focusing on active learning. Question 13 scrutinized the classroom environment, specifically student-related issues, encompassing eight items (BTBG13A, BTBG13B, BTBG13C, BTBG13D, BTBG13E, BTBG13F, BTBG13G, and BTBG13H). Lastly, question 21 centered on professional development and was divided into two sub-questions: previous professional development in the past two years (PDP) in question 21A and the anticipated need for future professional development (PDF) in question 21B. Both sections contained seven identical items. Notably, a similar assessment labeled as question 22 was utilized for the mathematics teacher questionnaire, wherein item content was slightly modified to incorporate mathematics instead of science.

3. Data Analysis

The primary analysis for this study entailed employing partial least squares structural equation modeling (PLS-SEM). This modeling approach was deliberately selected due to its efficacy in handling secondary data and its robustness in managing multiple layers of dependent variables (Hair et al., 2022). The cSEM package (Rademaker & Schubert, 2020), operating within an R statistical environment (R Core Team, 2023), facilitated the execution of the

PLS-SEM analysis, ensuring a comprehensive and meticulous examination of the data. Moreover, SPSS 22.0 (IBM Corp., 2013) was used for preliminary analysis, missing data imputation, and descriptive statistics analysis.

3.1 Measurement Model Assessment

The assessment of the measurement model encompassed an exhaustive evaluation of convergent validity, internal consistency reliability, and discriminant validity, adhering closely to the criteria recommended by Hair et al. (2022). Convergent validity necessitated factor loadings surpassing 0.40 and average variance extract (AVE) exceeding 0.5. Ensuring internal consistency reliability involved scrutinizing Cronbach's alpha (α) and composite reliability (CR) values, aiming for a range between 0.60 and 0.95. Discriminant validity, crucial to establishing construct distinctiveness, was evaluated utilizing the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). As per guidelines, the Fornell-Larcker criterion stipulates that the square root of the AVE for each construct should surpass its correlation with other constructs. Furthermore, the HTMT values should remain below 0.85, indicating distinctiveness among constructs.

3.2 Structural Model Evaluation

Within the PLS-SEM framework, assessing the structural model involved scrutinizing several key metrics to ascertain its quality and robustness. Collinearity, gauged through the Variance Inflation Factor (VIF), was meticulously examined, aiming to maintain values below 5 for optimal model acceptability. Path coefficients were rigorously evaluated utilizing confidence intervals derived from 10,000 bootstraps, as recommended by Hair et al. (2022). Moreover, Hair et al. (2022) suggested prioritizing confidence intervals over *t*-values or *p*-values for hypotheses acceptance decisions. Specifically, the value in 95% confidence level must have the same sign - either all positive or all negative. For the predictive power of the model, R^2 , f^2 , and Q^2_{pred} were calculated. While striving to maximize R^2 to gauge the explained variance, caution was exercised against excessively high values that could signify potential overfitting. Moreover, Kock (2015) suggested that the model with R^2 or R^2_{adj} smaller than 0.02 should be revised. Furthermore, effect sizes (f^2) were employed to assess predictive power, with benchmarks of 0.02, 0.15, and 0.35 denoting small, medium, and large effects of predictor constructs, respectively (Cohen, 1988). Finally, the out-of-sample predictive power of the model (Q^2_{pred}) was calculated to ascertain its robustness. After confirming that the Q^2_{pred} of each item was greater than 0, the number of indicators outperforming established benchmarks was considered. Minority, majority, and all outperformed indicators refer to low, medium, and high predictive power, respectively (Shmueli et al., 2019).

Results

Upon initial analysis, certain items were excluded due to factor loading falling below 0.40. Additionally, for the sake of bolstering convergent and discriminant validity, some items with factor loadings ranging between 0.40 and 0.70 were also removed. However, in the case of CT, convergent validity cannot be fulfilled except by becoming a single-item construct. Consequently, the means of all items was utilized as a surrogate for this construct, ensuring the absence of missing information resulting from item removal.

The retained items, accompanied by their descriptive statistics, convergent validity testing parameters, and VIF, have been reported in Table 2. All parameters of each construct are in an acceptable range, including factor loading from 0.570 to 0.951, Cronbach's alpha and CR from 0.679 to 0.947, and AVE from 0.510 to 0.877. It should be noted that CT has no reported values for convergent validity parameters because it is a single-item construct. The model also exhibited successful compliance with both Fornell-Larcker and HTMT criteria for discriminant validity, as convincingly illustrated in Table 3. Notably, VIF values for all items consistently remained below 5, reaffirming the validity of the structural model (see Table 2). Furthermore, Table 4 presents a comprehensive summary of path coefficients, inclusive of confidence interval levels and outcomes from hypothesis testing. Among the ten hypotheses tested, five have been accepted because zero is not included in the 95% confidence level interval.

Table 2 Descriptive statistics and factor loading of each item and convergent validity parameters of each construct

Construct	Items	Mean	SD	Factor loading	VIF	Cronbach alpha	CR	AVE
EAS_T	BTBG06A	1.568	0.609	0.768	2.132	0.86	0.892	0.625
	BTBG06B	1.721	0.636	0.825	2.743			
	BTBG06C	1.942	0.832	0.756	1.829			
	BTBG06D	1.715	0.625	0.931	2.358			
	BTBG06L	2.134	0.863	0.647	1.438			
EAS_O	BTBG06E	2.421	0.981	0.707	2.597	0.907	0.87	0.533
	BTBG06F	2.691	1.035	0.696	2.968			
	BTBG06H	2.343	0.967	0.57	2.963			
	BTBG06I	2.14	0.878	0.689	2.36			
	BTBG06J	2.538	0.911	0.739	3.117			
ENV_Sc	BTBG06K	2.197	0.749	0.932	1.649	0.877	0.903	0.757
	BTBG07A	1.607	0.6	0.756	2.743			
	BTBG07B	1.579	0.579	0.909	3.377			
ENV_St	BTBG07C	1.633	0.577	0.935	2.011	0.845	0.882	0.715
	BTBG07D	1.948	0.672	0.862	1.829			
	BTBG07E	2.052	0.625	0.937	2.226			
ENV_R	BTBG07F	2.285	0.712	0.725	2.14	0.861	0.934	0.877
	BTBG07G	1.73	0.545	0.921	2.338			
JS	BTBG07H	1.756	0.58	0.951	2.338	0.937	0.947	0.783
	BTBG08A	1.877	0.73	0.859	3.186			
	BTBG08B	1.821	0.703	0.889	3.662			
	BTBG08C	1.672	0.668	0.904	3.223			
	BTBG08D	1.758	0.701	0.937	4.242			
CT ^a	BTBG08E	1.758	0.743	0.831	3.371	0.718	0.819	0.608
	BTBG09	2.023	0.485					
IP	BTBG12B	1.931	0.795	0.741	1.422	0.701	0.828	0.619
	BTBG12F	2.067	0.849	0.634	1.349			
	BTBG12G	1.719	0.761	0.935	1.471			
CS	BTBG13E	2.43	0.613	0.805	1.428	0.679	0.806	0.51
	BTBG13F	2.307	0.574	0.882	1.48			
	BTBG13G	2.073	0.68	0.657	1.27			
PDP ^b	BTBS21AB	1.335	0.472	0.715	1.272	0.697	0.797	0.574
	BTBS21AD	1.644	0.479	0.62	1.154			
	BTBS21AE	1.603	0.49	0.749	1.481			
	BTBS21AG	1.631	0.483	0.764	1.361			
PDF ^b	BTBS21BB	1.156	0.363	0.693	1.306	0.697	0.797	0.574
	BTBS21BF	1.181	0.386	0.625	1.452			
	BTBS21BG	1.229	0.421	0.923	1.353			

^aCT is a single-item construct where the value is an average of every item in question BTBG09.

^bThe variable names for the mathematics teacher questionnaire are BTBM22 with the same last two characters.

EAS_T = Emphasis on academic success (teacher's aspect), EAS_O = Emphasis on academic success (other's aspect), ENV_Sc = School environment (school's safety), ENV_St = School environment (students' behavior), ENV_R = School environment (school's rule), CT = Teacher's challenges, CS = Challenges from students, PDP = Past professional development, PDF = Future professional development, JS = Job satisfaction, IP = Instructional practices.

Table 3 Discriminant validity

	CS	CT	EAS_T	EAS_O	ENV_Sc	ENV_St	ENV_R	PDF	PDP	JS	IP
CS	0.619	0.173	0.124	0.170	0.175	0.220	0.059	0.054	0.043	0.184	0.010
CT	0.021	1.000	0.091	0.097	0.034	0.130	0.071	0.068	0.157	0.057	0.051
EAS_T	0.011	0.008	0.625	0.718	0.555	0.602	0.597	0.034	0.276	0.512	0.393
EAS_O	0.018	0.004	0.365	0.533	0.457	0.509	0.391	0.024	0.166	0.323	0.283
ENV_Sc	0.019	0.001	0.217	0.143	0.757	0.618	0.652	0.024	0.087	0.456	0.254
ENV_St	0.028	0.014	0.242	0.181	0.292	0.715	0.619	0.073	0.147	0.472	0.274
ENV_R	0.002	0.005	0.244	0.125	0.352	0.262	0.877	0.073	0.171	0.448	0.249
PDF	0.000	0.003	0.003	0.001	0.002	0.006	0.002	0.574	0.543	0.107	0.224
PDP	0.001	0.015	0.045	0.017	0.006	0.009	0.017	0.158	0.510	0.214	0.458
JS	0.024	0.002	0.230	0.115	0.176	0.193	0.157	0.012	0.034	0.783	0.449
IP	0.000	0.000	0.090	0.047	0.043	0.041	0.035	0.030	0.106	0.147	0.608

The values in the diagonal are the square root of AVE while the lower and the upper values are correlations and HTMT, respectively.

Table 4 Hypothesis testing results

Path	Path coefficient	t value	2.5% CI	97.5% CI	Result
CS → JS	0.069	1.766	-0.001	0.154	Reject
CT → JS	-0.044	-1.067	-0.128	0.034	Reject
EAS_T → JS	0.263	3.985	0.128	0.385	Accept
EAS_O → JS	0.018	0.286	-0.073	0.164	Reject
ENV_Sc → JS	0.144	2.39	0.027	0.26	Accept
ENV_St → JS	0.153	2.658	0.036	0.264	Accept
ENV_R → JS	0.086	1.387	-0.039	0.206	Reject
PDF → JS	0.069	1.429	-0.023	0.167	Reject
PDP → JS	0.066	1.633	0.006	0.164	Accept
JS → IP	0.384	9.152	0.312	0.475	Accept

Additionally, Table 5 presents the summary of R^2 and f^2 values. The adjusted coefficient of determination (R^2_{adj}) for the endogenous variables, JS and IP, is 0.313 and 0.146, respectively. As both values exceed 0.02, no revision was necessary for the model. Despite the significance of certain path coefficients, most effect sizes related to JS fall below 0.02, indicating notably weak effects that could be considered irrelevant. Notably, the paths from ENV_St and EAS_T to JS exhibit f^2 values of 0.020 and 0.051, slightly surpassing 0.02 and suggesting small effect sizes for these constructs. Furthermore, the path from JS to IP reveals an f^2 value of 0.173, signifying a medium effect size.

Table 5 Coefficient of determination (R^2 and R^2_{adj}) and effect size (f^2).

Construct	R^2	R^2_{adj}	f^2
CS			0.007
CT			0.003
EAS_T			0.051
EAS_O			0.000
ENV_Sc			0.017
ENV_St			0.020
ENV_R			0.006
PDF			0.006
PDP			0.005
JS	0.326	0.313	0.173 ^a
IP	0.147	0.146	

^aThis is the value for JS → IP while the others are paths to JS.

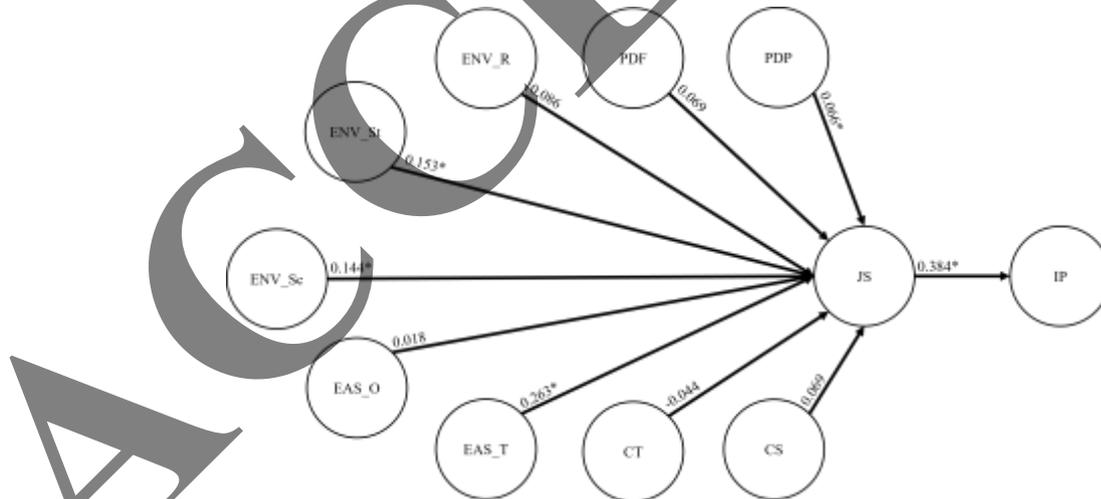
**Figure 3** The result of this study. The values with an asterisk are significant at a 95% confidence level.

Table 6 illustrates Q^2_{pred} for items within both endogenous constructs: JS and IP. Given the study's focus on teachers' job satisfaction (JS), the discussion specifically revolved around Q^2_{pred} related to JS. The table reveals positive Q^2_{pred} values for all items within JS. The subsequent step involves comparing prediction errors against benchmarks. Following the suggestion by Hair et al. (2022), this study utilized root mean squared error (RMSE) due to a prediction error distribution that is not highly non-symmetric. Notably, all RMSE values for items associated with the primary endogenous variable (JS) surpass the benchmark, indicating a model with remarkably high predictive power. Similarly, the mean absolute error (MAE) for all JS items in this model also outperforms the benchmark.

Table 6 Out-of-sample predictive power (Q^2_{pred}).

Construct	Item	RMSE	Benchmark	Q^2_{pred}	RMSE - Benchmark
JS	BTBG08A	0.655	0.667	0.198	-0.012
	BTBG08B	0.630	0.649	0.200	-0.018
	BTBG08C	0.599	0.619	0.197	-0.020
	BTBG08D	0.614	0.636	0.236	-0.022
	BTBG08E	0.679	0.686	0.174	-0.008
IP	BTBG12B	0.769	0.768	0.064	0.001
	BTBG12F	0.828	0.841	0.051	-0.013
	BTBG12G	0.736	0.734	0.067	0.002

Discussion

The insights gleaned from the partial least squares structural equation modeling (PLS-SEM), as depicted in Table 4, underscore the substantial influence of various factors on teachers' job satisfaction (JS). Notably, teachers' perspectives on school emphasis on academic success (EAS_T), school safety (ENV_Sc), and students' behavior (ENV_St), alongside their engagement in professional development within the past two years (PDP), emerge as significant influencers. Furthermore, this study also found that JS itself exerts a considerable impact on shaping teachers' instructional practices (IP). This multidimensional relationship underscores the interplay between these factors in delineating the overall landscape of teacher job satisfaction and its subsequent effects on teaching methodologies.

1. Teachers' emphasis on academic success influences their job satisfaction

The finding that EAS_T significantly influences JS resonates with existing research (Ker et al., 2022). This investigation, led by Ker et al. (2022), examined the JS of eighth-grade science teachers in the United States, utilizing TIMSS 2019 data. It delved into the distinct considerations of school emphasis on academic success for both teachers and students, highlighting its consequential impact on JS. Notably, this study revealed that only EAS_T significantly influences JS, contrasting with the broader EAS_O, which encompasses parental and student roles. Conversely, a study by Wang et al. (2019) using TALIS 2013 data supports the significance of EAS_O, presenting a potential contradiction.

This contradiction might be explained by two factors. Firstly, the involvement of external stakeholders could vary considerably across different contexts, leading to diverse outcomes. Secondly, the participant's interpretation of the items plays a role. Some items in the TIMSS 2019 survey's EAS_O construct could be interpreted positively or negatively. For instance, item BTBG06G, 'Parental expectations for student achievement,' might be construed positively (indicating parental support for student achievement) or negatively (attributing student failure to the school or teachers). Different teacher experiences and interpretations may affect the responses and consequently dilute the effects. Moreover, the TALIS 2013 items used in Wang et al. (2019)'s work are more specific compared to the TIMSS 2019 items. Further exploration, integrating detailed insights into these stakeholder groups, holds the potential to offer a more nuanced understanding of this intricate relationship.

2. School's safety and students' behavior affect teachers' job satisfaction

The substantial influence of ENV_Sc and ENV_St on JS underscores a prevailing connection observed in diverse academic contexts (Han et al., 2023; Nalipay, 2023; Zhou et al., 2023). While several studies draw from TALIS 2018 data to reinforce this linkage, a comprehensive examination involving primary and secondary school educators in China, adopting a composite questionnaire from various research sources, corroborates this significant correlation (Han et al., 2023). Moreover, another insightful study shed light on the interconnection between ENV and the broader spectrum of well-being (Zhang et al., 2023). However, an investigation utilizing TALIS 2018 data from both Korea and Japan reported a non-significant outcome concerning this path (Niu et al., 2023). It is pivotal to note the nuanced variations in variable definitions by Niu et al. (2023), leading to divergent results. For instance, a comparable construct, "school delinquency and violence," exhibited significance for Japan but not for Korea in their study, emphasizing the contextual nuances influencing these outcomes.

An intriguing aspect worth highlighting is the distinctive observation concerning ENV_R, the only construct within the school environment category that does not significantly influence JS. Some studies have suggested that organizational justice has negative effects on teachers (Capone et al., 2019), which contradicts the findings of this study. Arguably, the limited impact of this construct on teachers' JS might be attributed to two specific items within it, which appear to focus more on student-related aspects. Consequently, the consequential effects on educators might be constrained, resulting in a lack of notable impact on their JS.

3. Previous professional development affects teachers' job satisfaction

The significance of professional development participation in the past two years (PDP) in bolstering teachers' job satisfaction (JS) consistently finds support across various studies within TIMSS 2015 and TALIS 2018 (Gouëdard et al., 2023; Kang & Mavrogordato, 2023; McJames et al., 2023; Perera et al., 2022; Zhou et al., 2023). Professional development has been shown to enhance teachers' instructional competence, as revealed by research indicating improvements in teachers' self-efficacy, competence, and pedagogy (Murphy et al., 2020; Putri et al., 2019). Variables such as self-efficacy consequently influence teachers' job satisfaction (Burić & Moè, 2020; Nguyen et al., 2019).

However, an intriguing discrepancy arises when comparing these findings with a study utilizing TALIS 2018 data from Japan and Korea (Niu et al., 2023). The study by Niu et al. (2023) highlighted the significant influence of both PDP and the need for future professional development (PDF) on JS, contrary to the current study's finding solely on the significance of PDP. The divergence in results between this study and Niu et al. (2023) could potentially stem from nuanced differences in the questionnaire design between TIMSS 2019 and TALIS 2018. Notably, while TIMSS 2019

employed a binary yes/no question format for both PDP and PDF, TALIS 2018 had varied question structures for these aspects (Mullis et al., 2020; Organisation for Economic Co-operation and Development [OECD], 2018). These differences in question formats might have yielded varying depths of insights into the professional development landscape, potentially steering the outcomes in different directions.

Another point to address is the number of items for both constructs. While there are a total of seven items each for PDP and PDF, the model only includes four and three items, respectively. This could potentially compromise the comprehensiveness of the constructs, making it challenging to compare their results with those of other studies. However, the included items still provide valuable insights into the constructs and how professional development influences teachers' job satisfaction.

4. Satisfied teachers implement various instructional practices

The intricate relationship between teachers' job satisfaction (JS) and the resultant impact on various instructional practices (IP) represents a crucial aspect of the educational landscape. Although the correlation between JS and students' outcomes has garnered considerable attention (Arens & Morin, 2016; Collie & Martin, 2017; Hoque et al., 2023), a comprehensive exploration of the intricate interconnections remains limited.

A pivotal study within the TALIS 2018 framework illuminated the positive influence of JS on the global quality of IP (Harrison et al., 2023). Notably, this concept of instructional quality closely aligns with the construct of IP outlined in the present study. The logical premise here lies in the fact that teachers with higher levels of JS tend to invest more in their teaching endeavors (Ihuez et al., 2018). Moreover, these contented educators demonstrate a heightened inclination and aptitude for effective teaching methodologies (Nkengne et al., 2021). This finding amplifies the importance of supporting teachers' job satisfaction, not only for teachers themselves but also for their students.

5. Contradict findings on teachers' challenges

Diverging from established literature, this study revealed non-significant paths, challenging prevailing findings. Notably, the study's insights into both teachers' challenges (CT) and challenges from students (CS) deviate from prior research. Contrary evidence arises from a study involving Sweden's eighth-grade mathematics teachers using TIMSS 2015 data, which found a close relationship between teacher perceptions of student discipline in school (aligned with CS) and JS (Toropova et al., 2020). Another contradiction emerges from a study involving Portuguese primary and secondary educators using TIMSS 2011 data, suggesting that administrative tasks and student misbehavior significantly impact teachers' well-being, albeit in a distinct context (Mota et al., 2023). Despite the differing dependent variables, these factors often exhibit a close relationship (Dreer, 2021; Yang et al., 2023), emphasizing their significance in influencing teachers' satisfaction with their profession. However, some studies also found negative but non-significant effects from students' behavioral problems and JS (Wang et al., 2019).

It is essential to highlight that the lower bound of the 95% confidence level intervals for CS hovers close to zero, reflecting a threshold between accepting and rejecting the hypotheses. The proximity to this boundary underscores the complexity and subtleties of measuring these variables accurately. Larger sample sizes and a more expansive array of item considerations could offer enhanced clarity in future investigations, refining our understanding of these nuanced associations within the teaching landscape.

A limitation of using an average value for CT must be noted. Because of the quality of the measurement model, a CT construct with more than one item cannot be achieved. As a result, an average of all items was used for the single-item CT construct. A study demonstrated that multi-item constructs significantly surpass single items in terms of their predictive validity (Diamantopoulos et al., 2012). Similar to CS, refining items in the questionnaire and expanding the sample sizes could provide a better understanding of how CT contributes to JS and in which aspects.

There is another noteworthy aspect to consider. While the PLS-SEM analysis found no significant effects of CS on JS, contradicting earlier literature, the descriptive statistics reveal interesting points. Table 2 sheds light on a prevalent concern among educators about challenges from students, particularly disruptive behavior (BTBG13E) and lack of interest (BTBG13F), which average 2.430 and 2.307, respectively, on a three-point Likert scale. Extensive scholarly literature (Arum et al., 2012; Chang & Taxer, 2020; Welsh & Little, 2018) corroborates the pervasive impact of disruptive student behavior, affecting not only teachers but also peers, the classroom environment, and even the students themselves. For educators, grappling with students' reluctance to adhere to behavioral norms exacts a toll, leading to heightened work-related stress (Supaporn et al., 2003), compromised well-being (Bakker et al., 2007), diminished self-efficacy, and a perilous pathway toward teacher burnout (Aloe et al., 2014). The need for support in managing students' behaviors was also reported by a study with early care and education teachers in the US (Zhao & Jeon, 2023). It was reported as one of the key factors in boosting their well-being. Addressing these issues is not only beneficial but imperative for teachers' well-being and conducive to fostering enhanced student behavior and outcomes.

6. Theoretical and practical contributions

The findings of this study enhance our comprehension of both theoretical and practical dimensions. Based on the JD-R theory, the discovery that only 4 out of 9 paths are significant heightens our awareness of the theory's scope. For example, incorporating subdimensions for both the demands and resources domains could offer a more robust scope of application and a deeper understanding of the applied contexts. Additionally, introducing a layer of subdimensions based on the importance or impact of each construct could also serve the aforementioned purposes. On the practical front, the findings of this study illuminate the ways to support teachers' job satisfaction. Although the effect size of every job satisfaction path is small, with some not significant paths, it still emphasizes the significance of professional development, the school environment, and the teacher's emphasis on academic achievement. While teacher educators should concentrate on classroom-related professional development (such as technological pedagogical content knowledge), training on curriculum and psychology (the teacher's emphasis on academic achievement) is also crucial.

Specifically, teachers also need to understand the school's curriculum, its goal, and how to effectively implement it in real settings which is an essential competence or "resource" for teachers. Furthermore, principals should view the school environment as a tool to provide teachers with "job resources" to support their working experience and job satisfaction. For instance, since items in TIMSS 2019 focus on school safety and security, installing security cameras around the campus could support teachers' perceptions of their safety. Additionally, this finding highlights another significance of teachers' job satisfaction, which is enhancing their instructional practices. Stakeholders should pay greater attention to teachers' satisfaction issues as they directly affect students' learning.

Suggestion

This study offers valuable insights into the complex factors shaping teachers' job satisfaction and its impact on instructional practices. It highlights the significance of teacher emphasis on academic success, school safety, student behavior, and previous professional development in influencing job satisfaction. While certain aspects, like emphasis on academic success, strongly influence satisfaction, other environmental factors, such as school safety and student behavior, play nuanced roles. Despite challenges from students not directly impacting job satisfaction, they remain essential considerations in shaping the teaching environment which directly affects both teachers and students. Moreover, teachers' job satisfaction positively contributes to a variety of teachers' instructional practices.

The study emphasizes the need for comprehensive policies that address diverse facets influencing teachers' satisfaction. Specifically, the findings of this study emphasize the importance of professional development, the school environment, and the teacher's emphasis on academic achievement on teachers' job satisfaction. Policymakers should focus on systematic teacher training, from the beginning of their career on curriculum and enactment to continuous professional development. Simultaneously, the policies should support teachers' working environment, especially in terms of their safety. By acknowledging and addressing these factors, policymakers can bolster teacher well-being, leading to better student outcomes and sustained retention of educators. In essence, this research underscores the interconnectedness between teacher satisfaction and student success, advocating for a supportive ecosystem that prioritizes educators' contentment for the betterment of education as a whole.

Limitations

It is necessary to note the limitations in both spatial and temporal respects. The focus of this study on Korea may restrict its extensive applicability on a global scale, potentially disregarding cultural, job status, and policy variances that impact the relationship between job satisfaction and instructional practices. Furthermore, the TIMSS 2019 data was collected prior to the pandemic, which may have an influence on the alterations in teachers' satisfaction and practices. Demographic factors such as gender and the teaching subject may introduce subtleties that affect this correlation. Additionally, relying on secondary data from TIMSS 2019 may limit the incorporation of diverse variables. Nevertheless, the TIMSS 2019 survey gathered a significant number of variables for further examination, which were not encompassed in this study. Future research could profit from broader data sources and a more inclusive approach to better comprehend these associations in diverse contexts.

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