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Review Article

Investigating Factors that Predict Japanese Science Teachers' Job Satisfaction: Evidence from TIMSS 2019

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ABSTRACT

Trends in International Mathematics and Science Study (TIMSS) 2019 data revealed that Grade 8 science teachers in several Asian countries (Chinese Taipei, Hong Kong SAR, Japan, and South Korea) reported lower job satisfaction levels than the international average. For example, while Japanese Grade 8 students ranked among the highest in science achievement on the TIMSS 2019, their science teachers reported the lowest job satisfaction composite scale score compared to the other 63 participating countries. Using teacher questionnaire data from TIMSS 2019, we utilized correlation analysis and multiple linear regression to uncover the answers to this research question: Which factors contribute to Japanese Grade 8 science teachers' job satisfaction? The results from the analysis indicate that working in a safe and orderly school environment was the strongest predictor of Japanese Grade 8 science teacher job satisfaction. The number of working hours, amount of perceived pressure exerted by their students' parents, participation in professional development focused on science curriculum, and adopting a constructivist orientation to science teaching were the other significant factors that predicted job satisfaction. Findings from this study have implications for Japanese educational policy stakeholders, school administrators, mentor teachers, science department leadership, and those invested in science teachers' professional development.

KEY WORDS: Science education; science teachers; teacher job satisfaction

INTRODUCTION

In recent years, the issue of teacher job satisfaction has gained increasing attention from policymakers, researchers, and educational stakeholders worldwide. As the cornerstone of educational systems, teachers play a crucial role in shaping future generations and driving societal progress. However, mounting evidence suggests that teacher job satisfaction is in decline across various global contexts, presenting a significant challenge to educational quality and sustainability. Global cross-cultural studies on teacher satisfaction have been performed using international large-scale assessments such as the Teaching and Learning International Survey (TALIS), the Trends in International Mathematics and Science Study (TIMSS), the Progress in International Reading Literacy Study, and the Programme for International Student Assessment. The TALIS 2018, which included several Asian countries, indicated that teachers in Singapore and Japan expressed above-average job satisfaction compared to the Organization for Economic Cooperation and Development (OECD) average whereas teachers in South Korea reported slightly lower satisfaction levels. Factors contributing to higher satisfaction included supportive school leadership, opportunities for professional development, and a sense of self-efficacy. However, challenges such as long working hours, high-stakes testing environments, and societal pressures were noted as potential detractors of job satisfaction in some Asian educational contexts.

However, the TIMSS 2019 results presented a different picture for Grades 4 and 8 mathematics and science teacher job satisfaction in some Asian countries, contrasting with the more positive outlook from earlier assessments. Specifically, the TIMSS 2019 data revealed that science teachers in several Asian countries (Chinese Taipei, Hong Kong SAR, Japan, and South Korea) reported lower job satisfaction levels than the international average. For instance, only 20% of the Japanese Grade 8 science teachers reported being "very satisfied" with their jobs. Similarly, in Chinese Taipei, Hong Kong SAR, and South Korea the Grade 8 science teacher job satisfaction averages were below the international average. These findings from TIMSS 2019 highlight important disparities in job satisfaction among different subject areas. Contrasting with the generally more positive picture presented by earlier findings from TALIS 2018, the TIMSS 2019 data suggest that subject-specific factors, grade-level factors, cultural factors, and recent changes in science education might be impacting science teacher satisfaction in these East Asian countries.

Among the 63 participating countries, Japan's Grades 4 and 8 science students ranked among the highest in performance on the 2019 TIMSS while their teachers reported the lowest composite scale score for job satisfaction. Although there exists a body of research related to factors contributing to teacher job satisfaction, most focus on one specific contributing factor (stress levels, socioeconomic conditions, emotional labor, number of working hours, etc.) relating to student

performance, job satisfaction for all K-12 teachers, focused on elementary school teachers only, on teachers working in content areas outside of science, or in a cultural context outside of Japan (Hojo, 2021; Matsuoka, 2015; Naono-Nagatomo et al., 2019; Niu et al., 2023; Reeves et al., 2016; Sato et al., 2020). In short, the existing literature lacks studies focused on Japanese Grade 8 science teachers' job satisfaction. To address this gap, we ask the following research question: Which factors contribute to Japanese Grade 8 science teachers' job satisfaction?

LITERATURE REVIEW

Teacher job satisfaction encompasses a wide range of factors, including the work environment, administrative support, professional development opportunities, and intrinsic rewards of teaching (Bogler, 2011; Dinham and Scott, 2000; Skaalvik and Skaalvik, 2009). When teachers are satisfied with their jobs, they are more likely to be motivated, engaged, and committed to their students' success (Hoque et al., 2023). Conversely, job dissatisfaction can lead to increased burnout, reduced effectiveness in the classroom, and a higher turnover rate, which negatively impacts teachers and the students they serve. The role of teachers as critical contributors in shaping future generations cannot be overstated.

Teachers' dedication, expertise, and passion significantly influence students' academic, emotional, and social development. However, the current educational landscape presents challenges that impact teacher job satisfaction. Understanding and addressing the factors that influence teacher job satisfaction is crucial, as it directly affects the quality of education provided and the overall well-being of educators. The combination of school, student, and teacher factors can significantly impact teachers' professional and personal lives, leading to concerns about work-life balance and potential burnout.

Japanese Teachers

The 2018 TALIS asked a nationally representative sample of lower secondary (Grades 7–9) teachers about their backgrounds, beliefs, and attitudes toward teaching, their work environments, and the professional development they participate in. Although Japanese teachers indicated that the cultural status of the teaching profession is higher in Japan as compared to the other participating countries, they reported that their job satisfaction (TALIS defines this as the sense of fulfillment and gratification that teachers get from their work) is lower than the OECD average. Only 40% of Japanese teachers reported being satisfied with their teaching contract (outside of salary), which was below the OECD average, even though they rated their satisfaction with their salaries above the OECD average. Japanese teachers also reported a greater desire to move to a different school and a higher dissatisfaction with their work environment than the OECD average.

While Japanese teachers perform similar duties to those of other teachers around the World, Japanese teachers often have a more demanding workload than their international peers due to various factors, including larger class sizes, more administrative responsibilities, and a stronger emphasis on participating in extracurricular activities, including participating in coaching sports and cultural festivals after school and on weekends. Sato et al. (2020) cited that staffing shortages negatively impact teachers' work environment and fatigue (Bannai et al., 2015). Using the 2018 TALIS dataset, Hojo (2021) found that the student–teacher ratio positively correlates with higher work hours and teacher workload stress. In addition, teachers may also be responsible for supervising students during lunch and recess periods and having school cleaning responsibilities after the academic classes finish for the day (Cooke, 2005).

Although Japanese teacher turnover is among the lowest in the world, there has been an increasing number of Japanese teachers taking leave due to high student–teacher ratios, long working hours, and workload stress (Hojo, 2021). In a white paper on *karōshi* (death by overwork), the Ministry of Health, Labor, and Welfare reported on Japanese teachers' responses to a survey about aspects of their workload. While the 35,640 teachers who participated reported an average workday of 11 h and 37 min, they also mentioned the cause of these excessive work hours, which included "heavy personal workload" and "sudden unexpected tasks" (Nippon.com, 2018). When asked what teachers felt was needed to address this, they suggested hiring more teachers, coaches, and support staff and how teachers might share teaching or homeroom duties. Since 2015, all Japanese workplaces with more than 50 employees must conduct periodic stress checks. Due to the rising concern about Japanese teachers' work-life balance and work stress, Naono-Nagamoto et al. (2018) developed the School Teachers Job Stressor Scale (STJSS) to align with the specific responsibilities of teachers. Based on the results from their exploratory factor analysis (EFA) of the STJSS, five factors were identified as relating to teacher work stress: Time spent outside of classroom teaching (office work and guiding extracurricular activities), self-assessment of one's ability as a teacher (self-efficacy), relationships with other teachers and supervisors, social interaction outside of teaching (community involvement), and duties outside of teaching (e.g., maintaining student safety and taking care of the school environment – cleaning, patrolling within the school, and conducting safety inspections). Japanese junior high teachers work 56 h a week, versus an average of 38 h in most developed countries; in addition to this staggering number of hours, Japanese school teachers work an average of 123 h of overtime each month, with an average school day lasting 11 h, 29 min (Osaki, 2022). Conducting a secondary analysis of the 2013 TALIS dataset, Matsuoka (2015) found that school socioeconomic status (SES) was indirectly related to teacher job satisfaction through the frequency of student behavioral issues. The teachers at higher SES schools were found to have higher job satisfaction as did younger teachers in their 20s as compared to teachers in their 50s, indicating that student factors, teachers' age, and

possibly years of teaching experience play a role in teachers' job satisfaction. Teacher self-efficacy plays a role in job satisfaction, with male teachers reporting higher self-efficacy than female teachers.

Japanese classrooms typically have larger class sizes compared to other countries. According to a report by the OECD, the average class size in Japan is higher than the international average (OECD, 2018, p. 215). Using the 2018 TALIS dataset, Hojo (2021) found that the student-teacher ratio positively correlates with higher work hours and teacher workload stress. Large class sizes can place additional demands on teachers as they strive to meet individual student needs and maintain discipline in the classroom. In addition, Japanese teachers are held to a very high professional standard and must maintain professionalism to serve as role models for their students. Although Japanese teachers have fewer classes to prepare for than their American and German counterparts, they experience increased pressure to craft and deliver polished lessons.

In prior studies, teacher collaboration played a key role in teachers' work satisfaction and could reduce feelings of isolation. One way that Japan does this is through *Jyugyou kenkyu* (教 育 研 究), lesson study, or research lessons (Lewis, 2000). Lesson study is a collaborative and iterative process in which teachers work together to improve their teaching practices and enhance student learning outcomes. During lesson study, a group of teachers, typically from the same grade level or subject area, collaboratively plan a lesson with a specific learning goal. For example, a lesson is taught by one teacher in front of the group while the others observe the students' responses and the effectiveness of the teaching strategies used. This process focuses on the teacher's instructional techniques, questioning strategies, and classroom management skills. After the lesson, the group engages in a rigorous and reflective discussion known as "kōshōkai" (講評会) or "post-lesson reflection." During this discussion, the observers provide feedback, share their observations, and offer suggestions for improvement. The teacher who taught the lesson reflects on their practice and actively seeks colleagues' feedback. The collective knowledge and expertise of the group are harnessed to refine the lesson and develop a deeper understanding of effective teaching strategies. According to their study, Reeves et al. (2017) found that teachers' collaborative interaction corresponded to higher job satisfaction.

Japanese Science Teachers

According to the TIMSS 2019 data, Japanese science teachers cited the fewest student-related challenges to instruction compared to the other 63 countries that participated in the study. This questionnaire asked about the frequency of student absence, to which teachers responded that it happens less frequently than in the other 63 countries that participated in the study. When questioned about the number of students who arrive at school feeling hungry or tired, the Japanese responses fell around the International Association for the Evaluation of Educational Achievement (IEA) country average or below. In terms of students being prepared for instruction, Japanese teachers rated their mathematics and science students at the top of the IEA list and, therefore, ready for learning. Thus, student-related factors are not a primary concern for Japanese math and science teachers.

Conceptual Model of Teacher Job Satisfaction

After investigating various models on teacher job satisfaction and reflecting on the literature, a conceptual model of teacher job satisfaction was developed that shows how the three constructs of school, student, and teacher factors impact teacher job satisfaction (Figure 1). In this representation, school and student factors influence the teacher factors; combined, these three constructs influence overall teacher job satisfaction. The school factors include school culture, safety, workload, and teacher support. Student factors include needs, behavior, commitment to learning, and parents' involvement with their education. Demographic data, teaching experience, self-efficacy, expectations/goals, and preparation fall under the teacher factor construct.

METHODOLOGY

This study is a secondary quantitative analysis of Japanese teachers' responses to the TIMSS 2019 Grade 8 Science Teacher Questionnaire. This questionnaire consisted of 24 questions that included teacher demographic questions (gender, age, years teaching, and teacher training), school emphasis on academic success, school environment, feelings related to teaching, challenges related to teaching, pedagogical approaches, the use of technology, science topics taught, science homework, science assessment, and professional development (focus and frequency).

Sample

The sample used in this study consists of 154 Japanese Grade 8 teachers embedded in 142 schools (Table 1). The average length of time teaching was 14.82 years (SD = 11.918). The school administrator questionnaire provided information about the location (e.g., urban, suburban, and rural) and the SES of the students they serve.

Measures

Science teacher job satisfaction on the TIMSS 2019 assessment is the outcome measure in this study. To study this multifaceted

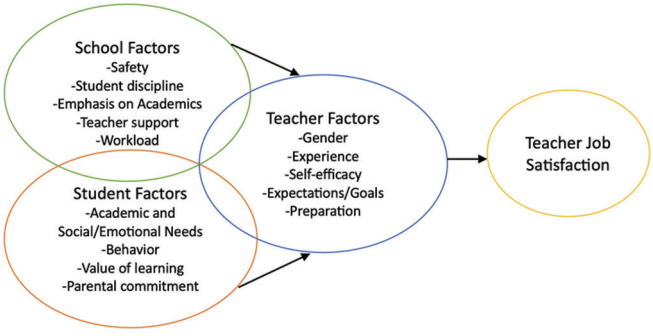

Figure 1: Conceptual model of teacher job satisfaction

Table 1: Teachers' demographic information

	Frequency	Percent	Average	SD
Gender				
Female	43	27.9		
Male	111	72.1		
Years teaching	154	100	14.82	11.918
Age				
Under 25	10	6.5		
25–29	31	20.1		
30–39	43	27.9		
40–49	31	20.1		
50–59	30	19.5		
60 or more	9	5.8		
Highest level of Education Completed				
Bachelor's degree	130	84.4		
Master's degree	24	15.6		
Doctorate	0	0		

construct, the science teachers' job satisfaction scale included a 4-point rating scale (1 = very often; 4 = never or almost never) responses to the following five statements: (1) *I am content with my profession as a teacher*; (2) *I find my work full of meaning and purpose*; (3) *I am enthusiastic about my job*; (4) *My work inspires me*; and (5) *I am proud of the work I do*. The predictor measures for our study include the teachers' responses to questions from the following questionnaire constructs: Teacher demographics, school emphasis on academic success, school environment, workload stressors, pedagogical approaches, student limitations to teaching, and professional development. The teacher demographic factors include age, years spent teaching, gender, and university major field of study. The teachers' school emphasis on academic success was explored through 12 items that focused on teachers, parents, students, and teacher collaboration. The three questions related to school safety probed teachers' feelings about their safety, the location of their school in a safe neighborhood, and the sufficiency of their school's security policies and practices. The characteristic student body behavior was reflected in the teachers' responses to five statements about students showing respect and the school's enforcement of rules.

Data Analysis

Our study began with downloading the dataset from the IEA website (iea.nl). The merge module in the IEA International Database Analyzer was used to extract and compile the Japanese data files. Using SPSS (v. 28), the teacher job satisfaction responses and frequencies were calculated. Correlation analysis was employed as an initial exploratory approach to analyze the large dataset. The relationship between the teacher job satisfaction scale and each item within the questionnaire's constructs was investigated using Pearson, Point Biserial, and Kendall Rank correlations, measuring the strength and direction of the linear relationship between the two scores.

Multicollinearity was checked for the independent variables, which resulted in the removal of teacher age, as it was highly associated with years of teaching. The years of teaching variable was retained as it demonstrated a higher correlation with job satisfaction.

Then, stepwise, forward multiple linear regression analysis was performed to explore the influence of the predictor variables from the correlation analysis on teacher job satisfaction. We verified assumptions such as linearity, independence, homoscedasticity, and normality of residuals. After creating a model to explain Japanese Grade 8 teacher job satisfaction, we explored the possibility of conducting multilevel modeling to determine if data clustering was present at the school level (level 2 units). We calculated the intraclass correlation coefficient (ICC) and considered it an indicator of whether there was evidence of clustered observations within level 2 units. Heck et al. (2014) noted that 0.05 is often considered a "rough cutoff" of substantial clustering. In our case, there was a lack of evidence regarding substantial clustering as the ICC was.002. Therefore, we abandoned multilevel modeling as a data analysis method.

RESULTS

The IEA Grade 8 Science Teacher Job Satisfaction Scale was examined for reliability, which was excellent ($\alpha = 0.91$). The responses to the individual job satisfaction items indicate that these teachers are proud of their work and find meaning and purpose in it (Table 2). However, the survey results indicate science teachers' concerns about feeling inspired and content with teaching.

Correlation Analysis

The correlational data analyses revealed significant associations between overall teacher job satisfaction and teacher demographic factors, school factors, and pedagogical approaches. Teacher age and the number of years teaching were significantly and negatively correlated with science teachers' reported job satisfaction at $p < 0.05$ level. Younger teachers and teachers newer to the profession reported higher job satisfaction. The school's location (urban, suburban, large city, medium-sized city, small town/village, and rural) was not significantly associated with teacher job satisfaction, nor was the student body income level (SES).

Safe and orderly schools

Teachers' perceptions of school safety and student behavior were positively and significantly correlated with their job satisfaction (Table 3). For example, the following questionnaire items were all significant ($p < 0.001$): *This school is located in a safe neighborhood*, *I feel safe at this school*, and *This school's security policies and practices are sufficient* were all significant. Concerning student behavior, *The students behave in an orderly manner* ($p = 0.025$), *The students are respectful of the teachers* ($p = 0.013$), *The students respect the property* ($p < 0.001$), and *This school's rules are enforced in a fair and consistent manner* ($p = 0.023$) were all significantly and positively correlated with teachers' job satisfaction. Because many significant correlations were found between

Table 2: Teachers' responses to job satisfaction items

Predictor	Percent				Valid N
	Never	Sometimes	Often	Very Often	
I am content with my profession as a teacher	1.3	20.8	54.5	23.4	154
I find my work full of meaning and purpose	1.3	15.6	55.8	27.3	154
I am enthusiastic about my job	0.6	18.2	61.0	20.1	154
My work inspires me	2.6	20.8	53.9	22.7	154
I am proud of the work I do	1.3	14.3	50.0	34.4	154

Table 3: Factors predicting science teachers' job satisfaction

Predictor	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
(Constant)	1.287	0.365		3.528	<.001
Safe and Orderly Schools Scale	0.343	0.087	0.273	3.943	<.001
Participated in past PD – Science Curriculum	0.290	0.095	0.231	3.073	0.003
Too much pressure from parents	−0.156	0.064	−0.180	−2.461	0.015
Ask students to plan experiments	0.144	0.061	0.164	2.373	0.019
Ask students to read textbooks	−0.136	0.048	−0.193	−2.834	0.005
Years teaching	−0.012	0.004	0.223	−3.087	0.002
Need future PD on Science Curriculum	−0.209	0.101	0.159	2.056	0.042
Too many teaching hours	−0.111	0.055	−0.147	−2.037	0.044

Dependent Variable: Teachers Job Satisfaction/IDX

this construct's items, we investigated the association between the Safe and Orderly Schools Scale, which combined all eight questionnaire items mentioned above with teacher job satisfaction. This was positively and significantly associated with science teachers' job satisfaction ($p < 0.001$).

Job stressors

Among the seven teacher workload stressors on the questionnaire, only two items were negatively and significantly associated with teacher job satisfaction: *I have too many teaching hours* ($p = 0.018$), and *I feel too much pressure from parents* ($p < 0.001$). When asked about student-related teaching limitations, *Uninterested students* ($p = 0.013$) was the only significant and negatively associated item with teacher job satisfaction. Significant and positive correlations existed for many items in the School Emphasis on Academic Success construct. The most significant of these items were *Teachers' degree of success in implementing the school's curriculum*, *Teachers' expectations for student achievement*, *Students' desire to do well in school*, and *Students' respect for classmates who excel academically* at $p < 0.001$ level. Since so many items within this construct were highly associated with teacher job satisfaction, we examined the correlation between the School Emphasis on Academic Success Scale and teacher job satisfaction, which combined all 12 items, including the significant ones above. The association of this scale with teacher job satisfaction was positive and significant ($p < 0.001$).

Pedagogical approaches

While no general pedagogical approaches were found to be correlated with teacher job satisfaction, seven out of the 14 science-specific pedagogical approaches were found to be significantly and positively associated: *Asking students to observe phenomena* ($p = 0.023$), *Asking students to plan experiments* ($p = 0.033$), *Asking students to conduct experiments* ($p = 0.018$), *Asking students to interpret data* ($p = 0.016$), and *Asking students to work in mixed ability groups* ($p = 0.003$). *Asking students to read textbooks* ($p = 0.045$) had a significant and negative relationship with science teacher job satisfaction. The pedagogical approaches associated with constructivist approaches were positively associated with teacher job satisfaction; however, reading textbooks was negatively associated. Looking at this in context with the significant findings, the frequency with which the teachers employed constructivist approaches was associated with higher science teacher job satisfaction.

Participation in professional development

When asked about past and future PD, most items within the construct, including the number of PD hours a teacher completed, were not significantly associated with job satisfaction. However, the two questionnaire items related to science teachers' participation in past and future PD *focused on science curriculum* were positively and significantly associated with their job satisfaction. Other foci of PD (science content, science pedagogy, integrating technology, critical thinking, science assessment, and student needs) were not significantly correlated with teacher job satisfaction.

Regression Analysis

A multiple regression analysis was conducted to determine variables that predicted science teacher job satisfaction from school, student, and teacher factors. Using a forward, stepwise approach to multiple linear regression, successive models

added all the highly significant factors to the regression equation resulting in a final model with the following equation:

$$y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e$$

where:
y=Teacher Job Satisfaction
b_0=Intercept
$b_{1\text{-}8}$=Slope coefficient for each independent variable.
X_1=Safe and orderly schools scale.
X_2=Participated in PD focus on science curriculum within the past 2 years.
X_3=I feel too much pressure from parents.
X_4=Ask students to plan experiments.
X_5=Ask students to read textbooks.
X_6=Years teaching.
X_7=Need future professional development focused on science curriculum.
X_8=I teach too many hours.
e=Model error

The overall model fit was statistically significant, as indicated by an F-statistic of 143.790 with $p < 0.001$ ($F(8, 149) = 9.493$), suggesting that the model explains a significant portion of the variance in teacher job satisfaction for this population. The adjusted R^2 value of.37 further illustrates that our model can account for approximately 37% of the teacher job satisfaction variability, highlighting the included predictors' substantial impact.

The variables previously mentioned in the correlation analyses were found to be significant and positive predictors of these science teachers' job satisfaction: *Being in a safe and orderly school* ($t = 3.943$, $p < 0.001$), *having participating in PD focused on science curriculum within the past 2 years* ($t = 3.073$, $p < 0.001$), *asking students to plan experiments* ($t = 2.373$, $p = 0.019$), and *need future professional development focused on science curriculum* ($t = 2.056$, $p = 0.042$). The model also indicates the presence of several factors that have significant and negative impacts on teachers' job satisfaction: *I feel too much pressure from parents* ($t = -2.461$, $p = 0.003$), *asking students to read textbooks* ($t = -2.834$, $p = 0.005$), *number of years teaching* ($t = -3.087$, $p = 0.002$), and *I have too many teaching hours* ($t = -2.037$. $p = 0.044$).

The standardized regression coefficients (beta weights) allow the comparison of the relative importance of different predictors. The larger the absolute value of the beta weight, the stronger the predictor's influence on the outcome variable. The model indicates that working in *safe and orderly schools* and *participating in PD focused on science curriculum* are the two variables with the highest predictive ability on Japanese Grade 8 science teachers' job satisfaction. Following these variables, *too much pressure from parents* was the next strongest predictor.

DISCUSSION

Our theoretical model contains three constructs that predict teacher job satisfaction: school, student, and teacher-related factors. Previously, we examined both correlations and the predictive ability of variables from these constructs to uncover their relationships with Japanese Grade 8 science teacher job satisfaction. Our analysis found factors from all the above constructs that demonstrated different levels of influence on Japanese Grade 8 science teacher job satisfaction. The greatest predictor of Japanese teacher job satisfaction was their perception of working in safe and orderly schools followed by participating in and needing future PD focused on science curriculum. Sensing too much pressure from parents decreased their job satisfaction as did working too many teaching hours. Asking students to plan experiments resulted in higher teaching satisfaction while asking students to read textbooks predicted a decrease in job satisfaction. Finally, being a newer science teacher predicted higher job satisfaction.

School-related Factors

In our regression model, the *Safe and Orderly Schools* scale strongly predicted Japanese Grade 8 science teachers' job satisfaction. This scale was generated from eight items that probed teachers' feelings about the location of their school in a safe neighborhood, their perceived safety, the sufficiency of the school's security policies, student respect and behavior, and school rules. One of the areas of significant teacher stress is the number of responsibilities outside of their teaching, including maintaining school safety which aligns with Naono-Nagatomo et al. (2019) findings. Matsuoka (2015) posits that the school body's SES influences teacher job satisfaction through the frequency of student behavioral issues. This indicates that Japanese teachers at higher-SES schools may face fewer student behavior problems, resulting in higher job satisfaction. Our finding that safe and orderly schools were the strongest predictor of job satisfaction is exciting, and perhaps indicates that the location of the school in a higher-SES neighborhood and/or the level of teacher responsibility to maintain safety predict teacher job satisfaction. This might also explain why a school's safety and orderliness are predictors of teacher job satisfaction for these Japanese Grade 8 science teachers.

In the regression model, *I have too many teaching hours* was a negative and significant predictor for job satisfaction. Despite efforts to reduce teachers' workload and thus their total work hours, the 2013 TALIS revealed that Japanese teachers spent about the same hours in the classroom as teachers in other countries. However, Japanese teachers spend excessive hours on administrative and extracurricular activities (Naono-Nagatomo, 2018). A study that explored the expectations of Japanese teachers compared with the reality of the number of hours they work found that they reported higher levels of personal enjoyment and job satisfaction when they did not work beyond their ideal working hours (Kagawa et al., 2023). Matsushita and Yamamura (2022) found that public junior high teachers worked 11 h or more per day, which was found to be associated with high stress as compared to those working 9–10 h. As reported in *The Mainichi* (April 2023), Japan's Ministry of Education, Culture, Sports, Science, and

Technology (MEXT or *Monbukagakusho*) found that 77.1% of Japanese junior high school teachers worked at least 50 h per week in October and November 2022. This equates to 11 h and 15 min of overtime a week, and if continued for the entire month, their overtime would reach 45 h a month. It was stated that 26.6% of Japanese junior high school teachers worked 60 h or longer per week, which puts their overtime hours over the "death by overwork" threshold of 80 h per month. Thus, the perception of Japanese teachers that they are working at a level beyond what they are comfortable with, coupled with the reality that they work longer than teachers in other countries, contributes to their stress levels, reducing their personal enjoyment and job satisfaction. More importantly, they are working at levels that put them at a high risk for mental health issues, burnout, and death.

Student-related Factors

Many scholars cite psychological problems and difficulties with human relationships as the cause of the increase in Japanese teachers quitting or taking leave from the profession due to depression and stress. For example, the Education in Japan Community Blog (2009) stated that these human relationship difficulties mainly focused on interactions with "monster parents" who sometimes have unrealistic expectations of their children's teachers. According to the National Institute for Educational Policy Research in Japan, parents expect a lot from teachers. In Japanese culture, parents' expectations are exceptionally high, exerting particularly high pressure on early-career teachers. According to Lassila et al. (2021), Japanese teachers experience intense pressure from students' parents due to deeply ingrained cultural and social norms. These pressures lead to a need for teachers to perform emotional labor. Unfortunately, these social and cultural norms give teachers little power to negotiate parental expectations. While the expectation is that parents and teachers can work together to ensure student success, the reality is that "the highly competitive nature of Japanese society, with its strong focus on meritocracy, increasingly leads many parents to assume a consumerist position toward schooling, especially in bigger cities" (Wakimoto and Choshi, 2015 as cited in Lassila et al., 2021, p. 3).

Furthermore, Lassila et al. (2021) cite research from Kudomi and Sato (2010) that explains the strain that may develop in parent-teacher relationships, with resulting in reduced cooperation and emotional distance, especially when students receive poor grades. In this situation, parents would often criticize teachers' capabilities, leading to stressful situations for Japanese teachers, who are expected to remain calm and professional, and requiring them to accept or submit to parental opinions rather than take a defensive stance. For all of these situations, teachers' emotional labor is required. "Instead of explaining to parents that they have misunderstood something, teachers are expected to take the blame and apologize for poor communication, thereby trying to create a second chance and restoring harmony" (Wakimoto and Choshi, 2015 in Lassila et al., 2021, p. 3).

Teacher-related Factors

In our regression model, years of teaching experience were negatively and significantly predictive of job satisfaction. In agreement with previous studies on Japanese teachers (Niu et al., 2023), those with fewer years of job experience report higher job satisfaction than teachers who have taught longer. Takahara (2014) asserts that this phenomenon is due to the "excessive workload of Japanese teachers" (p. 91). Thus, increased science teacher experience would predict lower job satisfaction. Within the scope of years of experience, it should be noted that senior teachers also have the responsibility of mentoring junior teachers not only through lesson study but also by guiding them through administrative duties, thus adding to their stress and job responsibility (Sato et al., 2020).

The frequency of science teachers *Asking students to plan experiments* was found to be a positive and significant predictor of science teacher job satisfaction while *Asking students to read textbooks* was a negative and significant predictor of teacher job satisfaction. Kambara (2020) found a positive outcome related to implementing constructivist, student-centered approaches to teaching on teachers' job satisfaction. In their study on constructivist approaches to teaching, Choi et al. (2018) found that learner-centered teaching had a significant and positive association with teacher self-efficacy and job satisfaction. Implementing constructivist approaches in Japan may be beneficial to heightening teachers' job satisfaction and self-esteem (Miyake et al., 2011). Our findings align with this, as one way to take a constructivist, student-centered approach in the science classroom is for teachers to ask students to plan and carry out their own experiments.

MEXT (2018) specifies that teachers have four prominent roles: planning lessons, teaching, assessment, and professional development. As mentioned previously, there is a formalized approach to teacher professional development as "lesson study," which is focused on teaching their subject's curriculum. Senior teachers are often responsible for leading this lesson study and in-service training (Matoba and Arani, 2005). Teachers' participation in past and future professional development focused on science curriculum was positively and significantly predictive of their job satisfaction. Participating in high-quality professional development is highly associated with teacher job satisfaction (Song et al., 2008). Desimone (2009) proposed a core conceptual framework highlighting the most important features of high-quality teacher PD, including ensuring it is aligned with teachers' content areas. Therefore, participating in science curriculum-focused professional development, such as lesson study, is considered high-quality professional development, positively contributing to science teachers' job satisfaction.

Key Takeaways

It cannot be ignored that most of the variables that predict Grade 8 science teacher job satisfaction in Japan are actually out of the teachers' hands. School safety, orderly students, workload, pressure from demanding parents, and access to

quality PD are the responsibility of the school administration, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and prefectural and municipal boards of education. According to Bjork (2000), "the Japanese principal is more of a coordinator than a leader, whose primary responsibility is to maintain school harmony and ensure that the institution runs smoothly" (p. 1). Thus, school safety and order are the responsibility of the school principal. The concerns about long working hours and demanding parents are probably culturally influenced so this factor might not be completely within the principal's purview, however, there should be a prioritization to develop strategies that protect teachers from these stressors. Luckily, there is one key factor within the science teachers' control that, according to our model, contributes to their job satisfaction – it is the pedagogical choices they make in the classroom. By taking a constructivist stance to teaching science such as asking students to perform hands-on science experiments instead of asking them to work out of their textbooks, they might feel higher job satisfaction.

CONCLUSIONS

This study shows that working in safe and orderly schools is the strongest predictor of job satisfaction for Grade 8 Japanese science teachers. These teachers are likelier to experience lower job satisfaction due to the unique physical and psychological stressors placed upon them by two unique cultural factors: the high number of hours they work and the parental pressure and criticism they experience. The frequent participation in professional development focused on science curriculum, such as lesson study, has the power to increase job satisfaction. Within the science teachers' power is choosing to enact student-centered strategies over didactic pedagogical approaches Measures must be taken to reduce teachers' workloads and insulate them from the demands of parents. MEXT, school boards, and school administrators must acknowledge the physical and emotional burdens placed on teachers and provide support to reduce the stressors that often lead to low job satisfaction. Finding ways to protect teachers from the criticism of students' parents might go a long way to improve these teachers' job satisfaction.

The findings from this study are limited as they are based on the items included in the TIMSS 2019 Grade 8 Science Teacher Questionnaire. One critical dimension the questionnaire did not explore in this iteration was teacher self-efficacy and motivation to teach. Given the limitations of the scope of the questionnaire, our findings are based on the available data and may not apply to contexts outside of Grade 8 science teaching in Japan. However, this study offers valuable insight into the working lives of Japanese Grade 8 science teachers and the factors that should be considered to improve their job satisfaction.

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