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The influence of principals' instructional leadership on teacher job satisfaction in Northwest China

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ABSTRACT

In education policy, principals' teaching leadership is key to improving education quality. It shapes school culture and affects various aspects of school development, including teacher job satisfaction. However, there is a limitation of empirical research on how principal instructional leadership impacts teacher job satisfaction in Northwest China, a less developed area, highlighting a critical gap in understanding local educational dynamics. Therefore, this quantitative study aims to explain the impact of instructional leadership by principals on teacher job satisfaction in junior high schools across Ningxia, China. Underpinned by a correlational design, the study specifically focuses on the relationship between principal instructional leadership and teachers' job satisfaction and the dimensions of instructional leadership that are most strongly associated with high levels of teacher job satisfaction. By analysing questionnaire responses from 372 randomly selected teachers, the research highlights that clear goal setting, effective curriculum coordination, and promoting professional development opportunities are important in improving teacher satisfaction. Interestingly, the study also shows that some commonly valued practices, such as high visibility and student progress monitoring, do not significantly influence teacher satisfaction. These findings highlight the importance of instructional leadership practices in improving teacher job satisfaction and suggest areas where school leaders can focus their efforts to enhance the overall educational environment.

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1. INTRODUCTION

Teachers play a vital role in national development as they nurture and educate the new generation [1]. Teacher job satisfaction has long been a key factor in a range of important educational outcomes, including teacher performance [2], [3], teacher retention [4], [5], and overall school performance [6], [7]. China's education system is well-known because it is highly competitive and requires teachers to devote an important part of their time and effort to teaching, student supervision, and classroom administration [8]. Due to the competitive pressure of the education system and high-intensity work requirements, Chinese teachers have consistently experienced high work pressure. This pressure arises from daily teaching tasks and includes strict requirements for students' grades and performance [9]. Because middle school students' academic performance directly affects their chances of being admitted to universities, middle school instructors in China are particularly affected by this situation [10]. To this end, the Ministry of Education of the People's Republic of China [11] has implemented a series of policies to improve teachers' job satisfaction with the

goal of “burden reduction”. Some specific measures include optimizing the curriculum, reducing the frequency of assessments, and providing more professional development opportunities and mental health support.

Given that teachers are an essential component of the educational process, it is crucial that they are content with their working conditions to ensure they perform well and provide their students with a high-quality education. They must have the attention of their direct leader or supervisor. These can be accomplished through the visibility of the principal or supervisor [12]. Teachers’ high job satisfaction significantly enhances their enthusiasm for work and mobilises their motivation. These teachers are more likely to be proactively involved in school activities, actively seek opportunities for their professional development, and be committed to achieving the school’s educational goals and vision [4]. On the contrary, lower job satisfaction among educators may lead to multiple negative results, including increased burnout among teachers themselves, reduced motivation, cut-down professional dedication, and a growing desire to leave the field of education [13], thereby negatively affecting student learning. Thus, the effectiveness of school leadership, especially the principal’s instructional leadership, is a significant factor in determining how satisfied teachers feel in their jobs. A key factor affecting teachers’ job satisfaction has been proven to be the instructional leadership demonstrated by the principal [14]–[16].

The impact of school principals on many educational outcomes, such as student achievement and teacher job satisfaction, is becoming more widely acknowledged, underscoring their crucial position as instructional leaders. There is a growing expectation for school leaders to oversee curriculum and instruction, foster educational reform, and assist teachers and students in their learning [17]. However, there is a consensus that the principal is the leader of the educational organization and one of the key determinants of the school’s success in achieving its goals [14]. Instructional leadership mainly refers to school leaders improving teachers’ teaching effectiveness and students’ learning effectiveness by guiding and managing school teaching activities and supporting teachers to develop their own professional level [18]. This leadership style is crucial because it directly relates to teacher performance and overall job satisfaction. To systematically assess the effectiveness of instructional leadership, various theoretical models have been developed. Among them, Hallinger and Murphy’s [18] model is widely used to analyze principals’ instructional leadership practices. Their framework focuses on three key components: defining school goals, managing instructional programs, and developing a positive school learning climate. These dimensions highlight the principal’s role in coordinating, supervising, and improving instructional activities, ultimately leading to better educational outcomes. This study will employ Hallinger and Murphy’s conceptual foundation to explore the role of instructional leadership [18]. Additionally, the principal instructional management rating scale (PIMRS) [19] will be used to assess principals' engagement in instructional leadership, as this scale has been validated across various educational contexts.

In education, the principal’s leadership is widely regarded as a major factor influencing school performance. Studies indicate that a principal’s instructional leadership style has a direct, positive impact on teacher effectiveness and, consequently, student learning outcomes [20]. Instructional leadership generally emphasizes leader behaviors such as curriculum coordination, classroom supervision, and teacher development [21]. Hallinger’s model [22], [23], further supports the idea that effective instructional leadership enhances teacher job satisfaction by fostering a structured and supportive learning environment. Based on these concepts, this study develops a conceptual framework to explore the link between principal instructional leadership and teacher job satisfaction, as shown in Figure 1. In many Western education studies, researchers have found that higher teacher job satisfaction is often closely linked to principals presenting effective instructional leadership behaviors. These behaviors include a continuous focus on teaching quality, support for teachers’ professional growth, and the creation of a positive school climate [16], [22], [24], [25]. Similar findings have been reported in various regions of China [26]–[28]. However, whether these conclusions hold true in Northwest China remains uncertain. Research findings from foreign educational contexts may not always be applicable due to significant differences in cultural, socio-economic, and institutional factors. Existing studies on instructional leadership in China are largely theoretical, lacking strong empirical support, particularly in underdeveloped regions [28].

This study seeks to address this gap by examining the influence of principals’ instructional leadership on teachers’ job satisfaction in Northwest China, a region with unique sociocultural and economic dynamics. Unlike previous research that broadly links instructional leadership to teacher outcomes, this study systematically deconstructs instructional leadership into ten sub-dimensions to identify the specific leadership practices that most strongly contribute to job satisfaction. By moving beyond general correlations, it offers a more granular and actionable perspective, providing valuable insights for educational policymakers and school leaders striving to enhance teacher satisfaction and school effectiveness in similar contexts. Since instructional leadership significantly influences teachers’ work experiences, it is crucial to examine the psychological and environmental factors that shape teacher job satisfaction. Lester [29], argues that the

fundamental measure of teacher job satisfaction is rooted in teachers' emotions and perceptions about diverse aspects of their profession. It is a complex structure affected by various conditions, including safety, recognition, income, promotion, work environment, colleagues and supervision. Herzberg's motivation-hygiene theory provides a useful theoretical framework for analyzing these factors. This theory categorizes workplace factors into two groups: motivational factors, which enhance job satisfaction, and hygiene factors, which prevent dissatisfaction. This theory posits that job satisfaction and dissatisfaction are influenced by two distinct sets of factors rather than simple opposition in the traditional sense [30]. In the school context, instructional leadership interacts with these factors in multiple ways. For instance, principals who provide clear professional development opportunities and recognize teachers' achievements address intrinsic motivators. Meanwhile, principals who ensure a structured and well-supported teaching environment help to manage hygiene factors. Therefore, examining instructional leadership through the lens of Herzberg's theory can offer deeper insights into how leadership behaviors translate into teacher satisfaction [31].

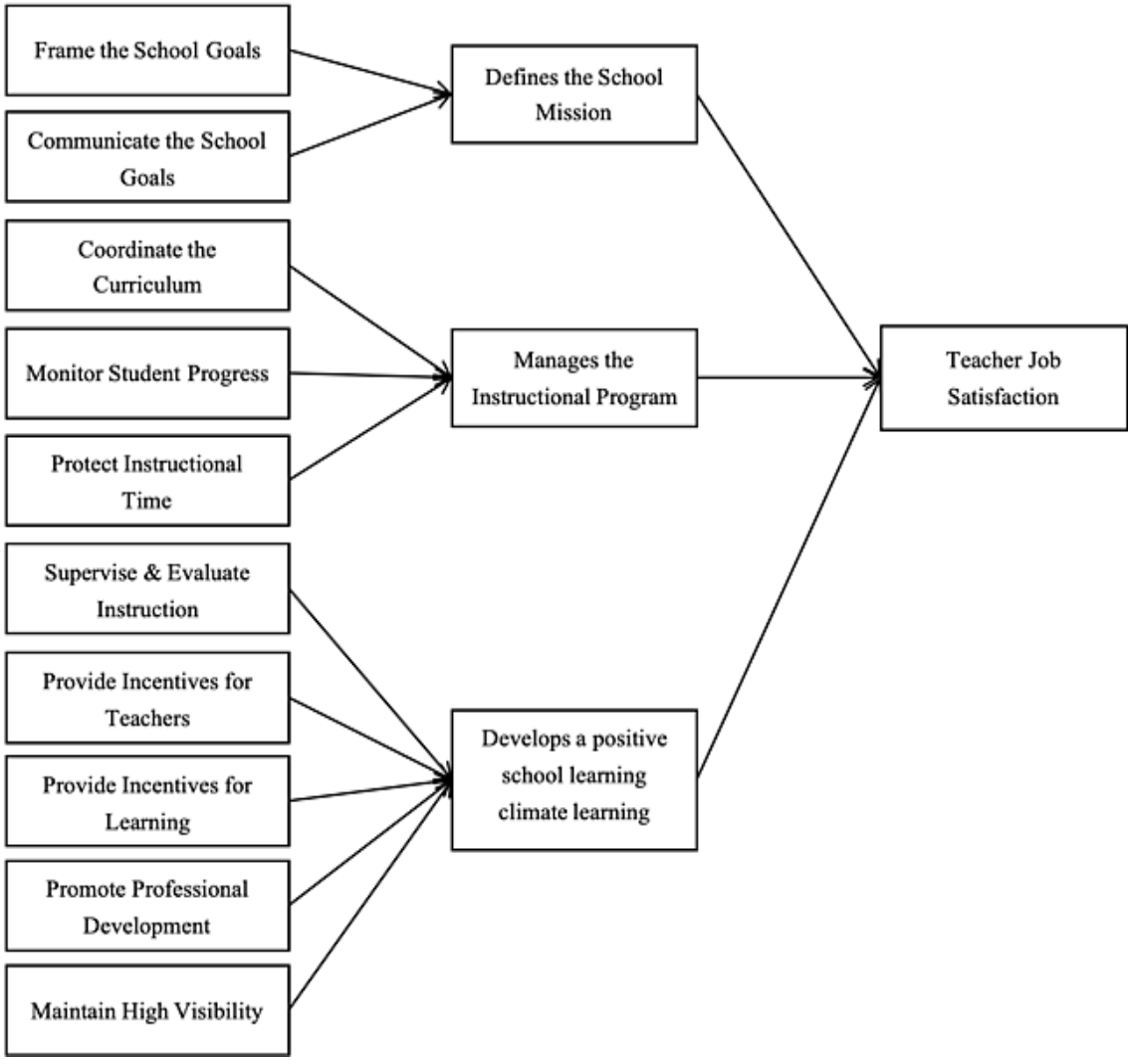

Figure 1. Research conceptual framework of principal instructional leadership and teacher job satisfaction

Extensive research highlights the positive impact of instructional leadership on teacher job satisfaction and performance. Studies have examined both direct and indirect pathways through which leadership affects job satisfaction. Liu *et al*. [16] found that both distributed and instructional leadership significantly enhance teachers' job satisfaction and self-efficacy, often mediated by collaborative teaching cultures and supportive school environments. Similarly, Kurnia *et al*. [15] demonstrated that instructional leadership in Indonesia's vocational secondary schools improved teacher satisfaction. However, Kouali [32]

found that although teachers expect instructional leadership from principals, this does not always translate into higher job satisfaction.

These conflicting findings highlight the need to identify which specific leadership behaviors most strongly influence job satisfaction. While many studies confirm a positive link between instructional leadership and job satisfaction, the mixed results suggest that only certain dimensions of leadership have a direct effect. Therefore, this study aims to analyze each sub-dimension of instructional leadership to determine its unique contribution to teacher job satisfaction in the Chinese educational system. Based on these gaps, this study aims to address two key research questions:

- Is there a relationship between principal instructional leadership and teachers' job satisfaction?
- Which dimensions of instructional leadership are most strongly associated with high levels of teacher job satisfaction?

2. METHOD

2.1. Design

This research was quantitative, as explained by Johnson and Christensen [33], involving the analysis of correlations between variables to determine whether one or more variables influence another. This research sought to investigate the effects of principals' instructional leadership on teacher job satisfaction, and correlational research was also used in this study. This was due to the fact that the goal of the study was to investigate how teacher job satisfaction and principal instructional leadership relate to one another. The correlational study design used statistical methods to describe and assess the strength and nature of relationships between two or more variables or data sets [33].

2.2. Sample

The research subjects were 372 junior high school teachers in Ningxia. The study used simple random sampling techniques to select participants. The research team first obtained a list of teachers from the local education department and assigned a number to each teacher. Subsequently, the researchers selected 400 teachers using a random number generator. However, only 372 teachers agreed to participate in this study. The participants of this study comprised 372 junior high school teachers from Ningxia Province. Data were collected using electronic questionnaires. In Table 1, 52.96% were female and 47.04% were male. Regarding educational level, the majority held a Bachelor's degree (69.89%), followed by those with a Master's degree (21.51%), and a minority with Doctoral degree (8.6%). Age distribution among the respondents showed that 48.12% were between 25 and 35 years old, 43.82% were between 36 and 45 years old, and 8.06% were between 46 and 55 years old. In terms of teaching experience, 26.08% of the teachers had been in the profession for 0-5 years; those with 6-10 years of experience constituted the largest group at 57.80%; those with 11-15 years of experience made up 8.60%; and those with over 16 years of experience accounted for 7.53%.

Table 1. Demographic information for the sample of teachers

Characteristic	Measure	Teacher sample (n=372) Frequency	%
Gender	Male	175	47.04
	Female	197	52.96
Qualification	Bachelor	260	69.89
	Master	80	21.51
	PhD	32	8.6
Age	25-35	179	48.12
	36-45	163	43.82
	46-55	30	8.06
Teaching experience	0-5	97	26.08
	6-10	215	57.80
	11-15	32	8.60
	>16	28	7.53

2.3. Instrument

The following scales were used to collect data for this study: the instructional leadership scale and the job satisfaction questionnaire. According to Lester [29], teachers' job satisfaction level was determined by how they view and value different aspects of their jobs. The scale included nine dimensions: supervision, working conditions, colleagues, salary, responsibility and promotion, security, work itself, and recognition.

The Likert scale model was utilised for the work satisfaction scale. Items on a job satisfaction measure included, for example: *"I get along well with my colleagues"* and *"The working conditions at my school are comfortable."*

The PIMRS, developed by Hallinger and Murphy [18], was adopted by the instructional leadership style scale. It included defining the school mission, managing the instructional process, and developing a school climate. This scale as well-made use of the Likert scale model. Items within the scope include: *"My principal created a specific set of yearly objectives for the full school"* and *"My principal gives formal rewards to students who are excellent at a public recognition meeting."*

The teacher job satisfaction questionnaire, structured around nine distinct dimensions, each comprising a varying number of questions, showed excellent internal consistency; Table 2 presents the reliability test results. The overall Cronbach's alpha coefficient for the questionnaire was 0.959, well above the 0.9 threshold, with all dimensions exhibiting coefficients greater than 0.7, considered acceptable in social science research [34]. This confirms that the questionnaire is reliable for measuring teacher job satisfaction. Similarly, the instructional leadership scale was assessed using Cronbach's coefficient alpha, which estimates the relatedness of items within a group. The reliability values for the ten subtests ranged from 0.84 to 0.910, indicating satisfactory reliability.

Table 2. Cronbach's alpha reliability coefficients of the teacher job satisfaction

Instruments	Dimensions	No. of items	Cronbach's alpha
Teacher job satisfaction	Supervision	8	0.931
	Colleagues	9	0.870
	Working conditions	6	0.854
	Pays	6	0.828
	Responsibility	7	0.834
	Work itself	8	0.903
	Advancement	4	0.838
	Security	3	0.722
	Recognition	3	0.744
	Total	54	0.959
Principal instructional leadership	Frame the school goals	5	0.887
	Communicate the school goals	5	0.910
	Coordinate the curriculum	5	0.891
	Monitor student progress	5	0.868
	Protect instructional times	6	0.860
	Supervise & evaluate instructional	5	0.863
	Provide incentives for teachers	5	0.847
	Provide incentives for learning	5	0.854
	Promote professional development	6	0.891
	Maintain high visibility	5	0.842
	Total	52	0.980

A confirmatory factor analysis was conducted using Amos software on the teacher job satisfaction questionnaire and instructional leadership scale. The analysis revealed positive model fit indicators: the chi-square to the degree of freedom ratio was 1.839, the root mean square error of approximation was 0.092, and the comparative fit index was 0.927. These values met the established standards for a good model fit, demonstrating strong consistency between the questionnaire's theoretical structure and the observed data. Similarly, confirmatory factor analysis of the principal's teaching leadership structure revealed encouraging results. The model fit indicators included a degree of freedom ratio of 1.690, a root mean square error of approximation of 0.083, and a comparative fit index of 0.907, all of which generally satisfied the criteria for an acceptable model fit, thus affirming that the theoretical structure of the principal's teaching leadership scale aligned well with the empirical data.

2.4. Data analysis

To thoroughly analyze the gathered data, the researchers employed inferential statistics. The primary methods used were Pearson correlation coefficients and multiple regression tests implemented using IBM Statistical Package for the Social Sciences (SPSS) statistics software. The Pearson correlation coefficient was strategically utilized to identify and quantify the relationship between the instructional leadership of principals and the job satisfaction levels among teachers. This statistical measure provided a clear understanding of how these variables are linearly correlated, highlighting the strength and direction of their relationship. Furthermore, multiple regression analysis was employed to delve deeper into the influence of various instructional leadership dimensions on teacher job satisfaction. This technique proved particularly valuable as it allowed for assessing the individual contributions of each leadership dimension while

considering the effects of other related variables. By using multiple regression, the study could isolate the effects of each leadership trait on job satisfaction, thereby offering detailed insights into which aspects of instructional leadership are most influential. These statistical methods are crucial for understanding the complex relationship between instructional leadership and teacher job satisfaction, providing clear insights that lead to dependable conclusions.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Relationship analysis test

The results demonstrating the relationship between principal instructional leadership and teacher job satisfaction are presented in Table 3. This Table 3 shows a statistically significant correlation between these variables, with a significance (sig.) value less than 0.05. Specifically, the Pearson correlation coefficient of 0.758 indicates a robust positive correlation between the instructional leadership practices of junior high school principals and the job satisfaction levels of their teachers (p=0.001). This significant finding confirms that principals' more effective and engaged instructional leadership is closely associated with higher teacher job satisfaction. These results underscore the importance of principal leadership in influencing teacher morale and satisfaction, suggesting that effective leadership is a critical factor in enhancing teachers' work experience and satisfaction.

Table 3. Relationship between principal instructional leadership and teacher job satisfaction

Variable	Pearson correlation	Instructional leadership	Teacher job satisfaction
Principal instructional leadership	Pearson correlation	1	0.758
	Sig. (2-tailed)		0.001
	N		372
Teacher job satisfaction	Pearson correlation	0.758	1
	Sig. (2-tailed)	0.001	
	N	372	372

3.1.2. Regression analysis

Regression analysis contains a suite of statistical methods utilized to predict or explain the value of a dependent variable based on one or more independent variables. This approach assists in understanding how changes in predictor variables are associated with changes in the outcome variable [35]. Teachers' job satisfaction is the dependent variable and the dimensions of principals' instructional leadership, including framing the school goals, communicating the school goals, promoting professional development, coordinating the curriculum, monitoring student progress, supervising and evaluating instruction, providing incentives for teachers, maintaining high visibility, protecting instructional time, and providing incentives to learn, as the independent variables. Discussing the effect of the independent variables on the dependent variable, the results obtained in Table 4.

Table 4. Effect of dimensions of instructional leadership on teacher job

Variable	B	Std. Error	Beta (β)	t	Sig.
Frame the school goals	0.101	0.025	0.153	4.063	0.000
Communicate the school goal	0.099	0.025	0.168	3.884	0.000
Supervise and Evaluate instruction	0.100	0.024	0.165	4.127	0.000
Coordinate the curriculum	0.110	0.024	0.180	4.500	0.000
Monitor student progress	0.015	0.027	0.024	0.562	0.574
Protect instructional time	0.088	0.024	0.148	3.644	0.000
Maintain high visibility	0.033	0.025	0.052	1.326	0.186
Provide incentives for teachers	0.084	0.024	0.137	3.444	0.000
Promote professional development	0.066	0.025	0.102	2.635	0.009
Provide incentives for learning	0.049	0.024	0.079	1.999	0.046

Table 4 presents the results of testing the research questions, where multiple regression analysis was conducted using the dimensions of principal instructional leadership as predictors and teacher job satisfaction as the dependent variable. The results showed that frame school goals (β=0.153, t=4.063, p<0.001), communicate school goals (β=0.168, t=3.844, p<0.001), supervise and evaluate instruction (β=0.165, t=4.127, p<0.001), coordinate the curriculum (β=0.180, t=4.500, p<0.001), and protect instructional time

(β=0.148, t=3.644, p<0.001), provide incentives for teachers (β=0.137, t=3.444, p<0.001), promote professional development (β=0.102, t=2.635, p=0.009) and provide incentives for learning (β=0.079, t=1.999, p=0.046) were significant positive predictors of teacher job satisfaction. Clear goals and communication give teachers a strong sense of purpose. Effective monitoring of instruction and curriculum coordination is critical, with curriculum coordination being particularly influential. Ensuring teachers have uninterrupted instructional time and providing incentives and opportunities for professional development are also key to increasing satisfaction. Overall, a positive teaching and learning environment largely depends on clear and supportive leadership. Moreover, monitoring student progress and maintained high visibility and was not a significant predictor of perceived teacher job satisfaction (β=0.024, t=0.562, p=0.574; and β=0.052, t=1.326, p=0.186, respectively). This suggests that they may not be as crucial in the study context or that other factors may overshadow their impact. While monitoring student progress and remaining visible are often considered good leadership practices, they may not directly impact teacher job satisfaction as much as the other dimensions listed.

3.2. Discussion

This study examined the influence of secondary school principals' instructional leadership on teachers' job satisfaction. While previous research has explored this relationship, there needs to be more literature regarding the impact of various dimensions of principals' instructional leadership on teacher job satisfaction. This study aims to address this gap by investigating how different aspects of instructional leadership affect teachers' satisfaction in their roles. The study's findings support the opinion that instructional leadership by principals and teachers' job satisfaction are strongly positively correlated. That means principals who show stronger instructional leadership tend to have higher job satisfaction among teachers. This is in line with earlier studies that have emphasized the crucial impact of effective leadership on increasing teacher satisfaction [15], [16]. Similarly, a study by Birhasani and Sulaiman [24] determined that leadership positively and significantly impacts teachers' satisfaction with their jobs. These studies consistently found that when principals effectively engage in these practices, they can significantly increase teacher satisfaction. The current study supports these findings and reinforces that positive and effective leadership plays a key role in increasing teacher satisfaction. However, the current study's findings contradict those of Kouali [32]. The research findings indicate that while teachers report high levels of job satisfaction, this satisfaction appears unrelated to either the principal's instructional methods or the general administrative approach. The quantitative results suggest two possibilities: first, teachers in this area may employ different standards when assessing principal effectiveness, and second, their job satisfaction is not directly linked to the principals' instructional strategies.

The regression analysis showed that some facets of instructional leadership had a greater impact than others. Teacher satisfaction is positively impacted by the principal's capacity to define the school's missions, monitor and evaluate teaching, coordinate the curriculum, and protect instructional time. These results mostly agree with Hao and Huang [28], who highlighted the importance of principals providing instructional leadership in setting educational goals, supervision, assessment, and teacher development. Additionally, principals who actively participate in these fields may have a more substantial beneficial influence on the job satisfaction levels of their staff.

When principals can clearly set out the school's instructional mission, this helps establish a clear direction and purpose so that teachers feel their work is meaningful and aligned with the school's overall goals. This consistency may enhance teachers' job satisfaction [28], [36]. The active involvement of principals in monitoring and evaluating instructional practices improves the quality of teaching and ensures that instructional activities meet expected standards. This type of supervision helps teachers improve and enhance their teaching methods and may make them feel supported and valued, thereby leading to higher satisfaction levels [37]–[40]. Effective curriculum coordination ensures that all subjects and grade levels match instructional plans and meet educational objectives. The principal's critical role in this process helps create an organised and collaborative teaching and learning environment, which positively impacts teachers' daily work experience [14], [41]. Principals protect instructional time by reducing unnecessary interruptions and optimising school operations to allow teachers to focus on their core instructional tasks [42], [43]. This emphasis on instructional time demonstrates respect and support for teachers' work and may enhance teacher satisfaction. These actions have been identified as having the most substantial impact on elevating teacher satisfaction levels. These insights necessitate school administrations to prioritize and develop competencies in these specific areas of instructional leadership to foster a supportive and satisfying work environment for teachers.

Interestingly, this research also highlights a subtle aspect of instructional leadership-while specific dimensions are effectively enhancing job satisfaction, not all are equally influential. Specifically, the practices of monitoring student progress and maintaining high visibility, traditionally regarded as traits of effective leadership, did not emerge as significant predictors of job satisfaction among teachers in this study.

This finding suggests that these aspects of leadership, although potentially beneficial for other outcomes like student performance or school accountability, may not directly contribute to teachers' job satisfaction. The results prompt a reevaluation of standard leadership practices, encouraging a more targeted approach where the impacts of specific leadership behaviours are closely examined in relation to teacher satisfaction. Such insights are crucial for developing more effective leadership strategies that align with the professional well-being of educators. This is because principal's leadership behaviours, such as establishing the school's mission and supervising the quality of teaching and learning, are directly related to teachers' day-to-day teaching activities and professional growth and, therefore, have a greater impact on teachers' job satisfaction [44]. However, behaviours such as monitoring student progress and maintaining high visibility, despite having positive effects on student learning outcomes and overall school operations, may have little correlation with teachers' personal and professional satisfaction. This nuanced understanding of leadership dynamics suggests that not all traditional leadership practices effectively enhance job satisfaction. Educational policy-makers and school administrators should consider these findings to tailor leadership development programs that focusing the most impactful practices.

Furthermore, the positive impact of providing incentives to teachers on job satisfaction is also noteworthy because it is consistent with Herzberg's two-factor theory [31], which emphasizes the importance of motivational factors (e.g., recognition and responsibility) in increasing job satisfaction. By recognising and rewarding teachers for their efforts, principals can create a more positive and motivating work environment, increasing job satisfaction. In contrast, factors like monitoring student progress and maintaining visibility, which did not significantly impact job satisfaction, can be seen as hygiene factors necessary to avoid dissatisfaction but do not necessarily enhance satisfaction when improved. By implementing recognition and reward systems that acknowledge teachers' contributions, principals can cultivate a more motivating and supportive workplace, ultimately leading to higher levels of job satisfaction among teachers [44]. These implications point towards a strategic reevaluation of leadership practices, aiming to align them more closely with the factors that genuinely enhance teacher satisfaction and overall school effectiveness.

4. CONCLUSION

This study effectively highlighted the significant impact of junior high school principals' instructional leadership on teacher job satisfaction in Ningxia Province, China, emphasizing the most impactful leadership dimensions. The findings confirm that successful school leadership beyond administrative tasks involves strategic instructional coaching and supportive interactions with staff. This research introduces novel insights by focusing on Northwest China a region with distinct socio-cultural and economic challenges-and dissecting instructional leadership into ten sub-dimensions, revealing that practices like goal alignment and curriculum coordination are pivotal, while visibility and progress monitoring are inconsequential. Such findings challenge universal leadership paradigms and underscore the importance of contextual adaptation. These results enrich the existing understanding and align with prior studies suggesting that adept instructional leadership fosters positive teacher outcomes.

In terms of limitations, the scope of this study is limited to the special cultural and institutional environment of junior high schools in Ningxia. This may limit the general applicability of the research results. This could be further studied by examining different geographical areas and educational settings to determine if the same trends continue. Studies comparing education systems internationally or in different regions of China may further clarify the generality or specificity of these findings. Future research directions could also consider other factors, such as teacher autonomy or student engagement levels, as mediators or moderators between teacher leadership and job satisfaction. In addition, in order to gain a deeper understanding of teachers' views and experiences on instructional leadership and job satisfaction, qualitative research can be attempted as a supplement to the quantitative results of this study.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

No potential conflict of interest was reported by the authors.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [BSA], upon reasonable request.

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