Article

A safe space and leadership matter for innovation: Exploring the role of psychological safety in the relationship between transformational leadership and innovation radicalness in Kyrgyz classrooms

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Abstract

The present research examines the relationship between school transformational leadership and innovation radicalness in classrooms with the moderating and mediating role of psychological safety, to provide an understanding of whether and to what extent the influence of leadership on innovation radicalness in teaching might be strengthened or weakened across various levels of psychological safety. Utilizing a dataset that included 5052 teachers working in 147 schools across Kyrgyzstan, we conducted multilevel analyses to test the proposed hypotheses. We found a positive association of transformational leadership with psychological safety and innovation radicalness in classrooms at the teacher level. Moreover, transformational leadership was more strongly related to radical innovation in schools with greater psychological safety among teachers both at the teacher and school levels. We conclude that school principals should prioritize the emotional state of teachers characterized by psychological safety by acting as transformational leaders, thereby enhancing the impact of their practices on the realization of higher innovation radicalness in the pedagogical practices of teachers.

Keywords

Central Asia, innovation radicalness, Kyrgyzstan, psychological safety, teachers, transformational leadership

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The prevailing view among educational leadership researchers is that school leadership could make a considerable difference in education systems through its contribution to the improvement of school processes and structures, people, and student outcomes (Leithwood et al., 2020). In particular, the current knowledge base provides much evidence bolstering the claim that effective school leadership is essential for high-quality teaching and learning and student achievement (Day et al., 2020). However, there are three main aspects in which this literature is still deficient. First, the available literature has yet to develop an understanding of how school leadership might promote innovation in schools (Pietsch et al., 2023; Prenger et al., 2022; Röhl et al., 2022; Schwabsky et al., 2020). The issue of innovation in education has proven particularly significant over the past decade, with educators worldwide facing a rapidly diversifying student body with increasingly varied needs due to wars, conflicts, and natural disasters leading to increased immigration (Schachner et al., 2019), alongside post-pandemic learning challenges (Engzell et al., 2021).

Second, current literature on educational innovation has centered its focus on the extent to which innovation occurs, rather than the type(s) of innovation and the degree (i.e. whether the innovation is radical or incremental). In addition, the extant research explores the relationship between transformational leadership and innovation, particularly regarding school climate (Moolenaar et al., 2010) and teacher capacity (Waruwu et al., 2020), but does not broach the basis of innovative pedagogical practices in the classroom (Vincent-Lancrin et al., 2019). Therefore, researchers have yet to develop knowledge of whether and how school leadership could promote more innovative teaching practices in classrooms (Pietsch et al., 2023).

Third, while educational leadership initially emerged as a separate field of research in English-speaking Anglo-Saxon cultures (e.g. the USA, England, and Canada), it has since gained considerable recognition across different countries around the globe. However, while some countries have a relatively long history of conducting and disseminating school leadership research, such as Turkey, Israel, and China (Gumus et al., 2018), numerous other countries have yet to contribute to the knowledge in this field (Pietsch et al., 2023). In particular, only a few empirical studies have investigated school education in Central Asia, with even fewer examining leadership in schools in this region, which is partly due to the fact that conducting educational research in post-Soviet Central Asia is considered sensitive and risky (Jonbekova, 2020). There is a dearth of evidence from nations like Kyrgyzstan, where school leadership was historically characterized by a "nonsystematic formation of their practices through stereotypes and their observations" (Sindhvad, 2021: 50).

Against these drawbacks, the present research serves two main purposes. First, it aims to examine the relationship between transformational school leadership and innovation radicalness in Kyrgyzstan classrooms to provide an understanding of the role that leadership plays in promoting innovation in teaching. In addition, the prior theoretical discussions have framed psychological safety as a moderating concept by asserting its potential to address the risk and stress associated with innovation (Hughes et al., 2018; Norman and Verganti, 2014). It might be essential when school leaders exert transformational leadership, which promotes risk-taking and innovative practices (Hallinger, 2003). Psychological safety has the potential to reduce stress, encourage knowledge sharing, foster innovation (Newman et al., 2017), and help principals facilitate teacher adaptation (Zhu et al., 2019). Thus, the second purpose of this research is to scrutinize whether and to what extent the influence of leadership on innovative classroom practices might be strengthened or weakened across various levels of teachers' collective sense of psychological safety.

Utilizing a dataset of 5052 teachers nested in 147 schools in Kyrgyzstan, this study employed a multilevel moderation analysis to address a significant issue in a context where the educational leadership literature has been extremely sparse.

Theoretical framework

This research utilizes the theory of transformational leadership to investigate how the impact of school leadership on teacher innovative practices can be enhanced. The theory of transformational leadership goes beyond the prominent social exchange theory that describes leadership as an exchange relationship between the leader and followers, in which accomplishments are rewarded and failure is punished (Bass and Riggio, 2006). Transformational leadership complements the notion of transactional exchange by recognizing and valuing the follower's self-worth to foster the follower's engagement in and commitment to the work at hand (Bass et al., 2003). This theory involves leaders empowering others, paying attention to their needs and personal development, and helping them to develop their own leadership capacity (Bass and Riggio, 2006). Thus, it motivates followers toward a commitment to shared goals and challenges them to develop original ideas and implement innovation (Nemanich and Keller, 2007). However, the emphasis on innovation implies uncertainty and risk (Hughes et al., 2018) and can trigger stress (Peters et al., 2017). Therefore, the concept of psychological safety might play a crucial role in this regard. Psychological safety can help people develop a sense of security and confidence in individuals, enabling them to change their behavior in response to challenges that might emerge from organizational innovation (Edmondson et al., 2016). We believe this concept might facilitate the realization of innovative practices emphasized by transformational leadership. Therefore, the research we propose here (see Figure 1) links transformational school leadership to innovative teaching
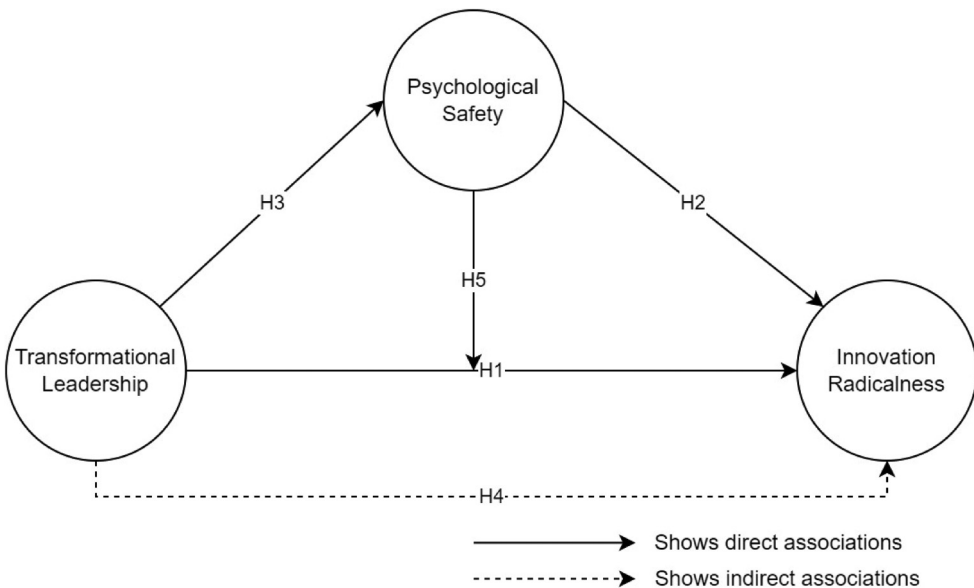

Figure 1. Conceptual framework.

practices in the classroom, both at the school and individual teacher levels, and introduces psychological safety as a moderator to augment the relationship between transformational leadership and innovative teaching.

Literature review and hypotheses

Innovation in education

The complex nature of the term "innovation" makes it challenging to generate an agreed-upon definition, yet the prominent *Oslo Manual* for measuring innovation has introduced a useful and comprehensive definition: "a new or improved product or process (or a combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)" (OECD/Eurostat, 2018). This definition illustrates that organizations, organizational sub-units, and individuals within organizations should enhance and/or renew their products and processes (Forés and Camisón, 2016); thus, it highlights two possible subjects of innovation (product or process) and two types of innovation (incremental or radical). First, innovation could refer to either a product or a process. Product innovation could be described as the introduction of a new or improved quality of a good or a service, whereas process innovation could be identified as a new or improved method of handling an issue (Damanpour and Aravind, 2009). Second, whether it involves a process or product, the innovation could take place in two ways: incremental or radical. Incremental innovation involves making improvements or refinements of a subject within a given frame; it seeks to take an existing product or process and try to do it better. Innovation radicalness, on the other hand, seeks to do something that has never been done before; it makes more fundamental changes to the frame by introducing an entirely new process or product (Forés and Camisón, 2016; Norman and Verganti, 2014). Consequently, innovation radicalness refers to the newness of a product or process and is associated with generative and higher-order learning processes (i.e. second-order learning, double-loop learning) of organizations and individuals (Domínguez Escrig et al., 2020).

Innovation has recently attracted increased attention from educational researchers. In this regard, it is evident that schools and their personnel mainly focus on incremental innovations and that innovation radicalness is low (Dedering and Pietsch, 2023). Educational institutions, however, can and should undergo significant improvements in their products and processes to meet the challenges of a globalized world (Serdyukov, 2017). For instance, schools should be able to implement new processes or products to address the needs of a student body that is constantly diversifying due to global issues such as the pandemic, war, and migration. The aforementioned framework for innovation could also be applied to school contexts. A school and its personnel may engage in product innovation by introducing new or significantly different products and services, including new syllabi or textbooks, or new pedagogies or educational experiences (e.g. e-learning or new qualifications). They could also undergo process innovation by changing their organizational processes for producing educational goods or services (Vincent-Lancrin et al., 2019). In the present research, we focus on process innovation in classroom practices (i.e. new pedagogical experiences). We are particularly interested in understanding the extent to which innovation that took place in teachers' pedagogical practices in the classroom over the past year tended to be rather radical. Moreover, we aim to examine to what degree transformational leadership could predict innovation radicalness in teaching practices.

Transformational leadership

Initially conceptualized by Burns (1978), transformational leadership is often contrasted with transactional leadership, which operates on the principle that followers obey and follow the directions provided by the leader in exchange for either receiving rewards or avoiding sanctions (Bass et al., 2003). Transformational leaders, however, inspire their followers to prioritize the success of the organization and motivate them to recognize the significance of achieving organizational goals (Hallinger, 2003). They are change agents who communicate a new vision that challenges the status quo and inspire subordinates to embrace new ideas and work collaboratively to achieve that vision (Nemanich and Keller, 2007). Considering the prominent four dimensions of transformational leadership—idealized influence, inspirational motivation, intellectual stimulation, and individual consideration—transformational leaders work strategically to enhance their followers' commitment, engagement, and collective confidence, which are key to effectively overcoming the challenges of the organization through original ideas and practices (Bass et al., 2003).

Transformational leadership has received particular attention from educational researchers during times of significant school reform initiatives. It became an increasingly important research topic when extensive initiatives were undertaken to redesign schools to meet the needs of 21st-century students (Leithwood and Jantzi, 2000). The reforms have often aimed to facilitate change and improve classroom practices (Elmore, 2007), and evidence suggests that transformational leadership can play a key role in this process (Supermane, 2019; Waruwu et al., 2020). For example, transformational leadership can promote teacher professional learning (Karacabey et al., 2022) and encourage teachers to make use of diverse classroom practices to better meet the needs of their students (Leithwood and Jantzi, 2000). In a study of Dutch schools, Moolenaar et al. (2010) found that when school leaders focused on establishing a shared vision and values, prioritizing the needs of individuals, and providing intellectual stimulation, they fostered school climates that supported innovation. Such leadership practices could reshape the organizational structures of schools and promote organizational learning. In turn, this could enhance teachers' capacity for innovation (Waruwu et al., 2020), which might be particularly important for innovative teaching. Finally, recent studies have supplied empirical evidence that transformational leadership could be directly associated with more frequent innovative classroom practices (Supermane, 2019). Based on recent findings and the theory of transformational leadership, we propose that:

H1: Transformational leadership is positively related to innovation radicalness in classrooms.

Psychological safety (for innovation)

Psychological safety has drawn the attention of researchers in many fields, including business and health (Higgins et al., 2022), since it is associated with increased performance in situations marked by complex and unclear tasks with high stakes (Tucker et al., 2007). The term is traced back to the seminal work of Schein and Bennis (1965), who initially linked it to change and defined it as individuals' confidence in their capacity to handle changes. Thus, psychological safety is a mental state required for such change to take place (Frazier et al., 2017). As a collective term, it refers to "a shared belief held by members of a team that the team is safe for interpersonal risk-taking" (Edmondson, 1999: 354). It involves interpersonal trust, which is the confidence one has in others to act in a way that benefits their interests, despite the possibility of vulnerability, and

extends further by creating an environment of mutual trust and respect where people feel comfortable being themselves (Edmondson, 1999).

Although the concept of psychological safety has been present in the literature for some time, it did not receive significant attention from educational researchers until recently (Zhu et al., 2019). Scholars have considered it a key ingredient of a school climate that fosters professional learning and promotes innovation (Moolenaar et al., 2010) because it allows teachers to be valued for their skills and talents, share positive intentions, engage in constructive conflict, and have the freedom to take risks and experiment (Edmondson, 1999). It contributes to the development of a type of school environment that fosters increased creativity and innovation within an organization (Zaman and Abbasi, 2020). The availability of a strong sense of psychological safety is likely to support teachers toward the generation of original ideas and concrete action whereas the lack of such feeling may increase the concerns among teachers that their new idea will lead to opposition and ridicule from others (Zhu et al., 2019). This enables us to hypothesize that:

H2: Psychological safety in a school is positively related to innovation radicalness in classrooms.

The concept of psychological safety is particularly important for school leaders who strive for innovation in teachers' behaviors and practices (Higgins et al., 2022; Yin et al., 2020). Prior evidence suggests that transformational leaders not only create an atmosphere that promotes innovation but also foster a psychologically secure environment where individuals feel comfortable disclosing their personal vulnerabilities (Yin et al., 2020). This enables the leaders to create a climate that is conducive to innovation and growth (Moolenaar et al., 2010). Especially in situations that are characterized by great uncertainty and require higher innovation radicalness, school leaders are called upon to provide the necessary psychological safety (Higgins et al., 2022). Transformational school leaders prioritize collaboration over competition by cultivating mutual support and confidence among teachers, reassuring them that their interests won't be jeopardized by other team members, thereby creating a strong feeling of psychological safety among teachers (Yin et al., 2020). Therefore, we hypothesize that:

H3: Transformational leadership is positively related to psychological safety.

Transformational leaders act as catalysts for change, by questioning the existing norms and practices and motivating followers to adopt new ideas and work collaboratively to realize them (Nemanich and Keller, 2007). This requires the availability of a positive work condition (De Clercq et al., 2016). A transformational leader, therefore, needs to cultivate a psychologically safe environment to foster increased knowledge sharing (Yin et al., 2020) and innovation among team members (Moolenaar et al., 2010). In a school, leaders are expected to support teachers in implementing innovative teaching practices to ensure the learning of all students. Transformational school leaders may not accomplish this before establishing a school environment that is safe and trusting enough to discuss and implement new ideas (Karacabey et al., 2022). Particularly, through individualized consideration, principals could provide emotional support, and via intellectual stimulation, school leadership might challenge teachers' negative feelings, both of which are key to facilitating the establishment of psychological safety among teachers (Xu et al., 2022). In such environments, the risk and fear of failure associated with innovation can be reduced (Cao and Zhang, 2020), and teachers would be more eager to implement innovative teacher practices in their classrooms.

H4: Transformational leadership is positively and indirectly related to innovation radicalness in the classroom through its direct effect on psychological safety.

Furthermore, school leaders are key personnel to lead changes in their schools to ensure overall improvement in school processes and student learning outcomes (Leithwood et al., 2020). In such a context, transformational leadership is a unique leadership style that emphasizes innovation (Nemanich and Keller, 2007). Compared to other leadership types, transformational leadership is more likely to promote innovation in teacher practices both schoolwide and in individual classrooms by supporting teachers as partners in decision-making (Hallinger, 2003). On one hand, innovation is associated with increased uncertainty and risk (Hughes et al., 2018). When innovation involves more radicalness that requires staff to implement new types of practices, the levels of uncertainty and risk increase (Norman and Verganti, 2014); such an experience is often described by neurobiologists as the main source of stress for individuals (Peters et al., 2017). Such a pernicious psychological state is likely to cause resistance to change (Schweiger et al., 2018). On the other hand, research has indicated that psychological safety reduces stress and strain and promotes knowledge sharing and communication, all of which are positively related to innovation and productivity (Newman et al., 2017). In turbulent situations, the availability of psychological safety among teachers could help school leaders facilitate teacher learning to adapt to the changing environment and conditions (Zhu et al., 2019). More recently, Chen et al. (2022) found that the impact of leadership on innovative teacher practices is strengthened with increased psychological safety among teachers, as it helps to "overcome barriers to learning and change in interpersonally challenging work environments" (Edmondson et al., 2016: 65). Based on this theoretical and empirical work, we hypothesize that:

H5: Psychological safety positively moderates the relationship between transformational leadership and innovation radicalness in the classroom, such that the association between transformational leadership and innovation radicalness is strengthened in schools with a stronger average perception of psychological safety among teachers.

Method

In our research, we applied cross-sectional survey analysis and multi-level structural equation modeling to test our hypothesis. The following sections describe the context, sample, data collection tools and procedures, and data analysis strategies.

Context

Our study used data collected in the Kyrgyz Republic. In Kyrgyzstan, the Ministry of Education and Science (MoES) is charged with the responsibility of developing and implementing education policies, along with regulating educational procedures, content, and initiatives. Regional educational authorities at the oblast and district levels fall under the MoES's supervision and are responsible for financing educational institutions, supporting their organization and management, and appointing their heads. This top-down approach has resulted in limited autonomy at the school level, making it challenging to establish a culture of innovation within schools.

Over the last decade, the education system in Kyrgyzstan has undergone significant reforms with the support of international donor organizations. These reforms have led to innovations such as the introduction of new curricula, the development of new schoolbooks, the establishment of

independent educational assessments, and a shift towards a student-centered learning approach (Sindhvad et al., 2020). More recently, the usage of digital tools in teaching and learning has also been introduced (Siarova and van der Graaf, 2021). Despite these efforts, the education system continues to follow the highly centralized school governance system of the former Soviet Union, which presents challenges for implementing innovations at the school level (Sindhvad et al., 2020).

Regarding school leaders, almost no concrete policies have been implemented to promote effective school leadership in the country (UNESCO, 2019). Although school leaders were given more autonomy in recent years, they were not provided additional training in educational management and leadership to support their increased authority (Chapman et al., 2005). Moreover, there is limited knowledge on the role of school leadership in creating a culture of innovation within schools in this region. Very few studies have empirically investigated the role of school leadership in Kyrgyzstan (Sindhvad et al., 2020), and these studies have relied upon very small sample sizes that allow few conclusions to be drawn about school leadership and its effects at the level of the entire Kyrgyz Republic.

Sample and data collection

For our study, we adopted a stratified cluster sampling procedure with public and private schools (primary, lower secondary, and secondary) from all seven regions (oblasts) of Kyrgyzstan, along with the two independent cities of Bishkek and Osh. For the sampling, all schools ($N = 2310$) in Kyrgyzstan's Educational Management and Information System (EMIS) were divided into subgroups based on the seven regions and two cities, according to geographic location (village and city) (see Table 1). Following the Organisation for Economic Co-operation and Development's (OECD) sampling strategy (OECD, 2018), we next used a random sampling procedure to select a total of 150 schools within these subgroups. All sampled schools received an official invitation

Table 1. Descriptive statistics of categorical variables.

	Frequency	Percent
School location		
Village	108	73.5
Small town	11	7.5
Town	15	10.2
City	7	4.8
Large city	6	4.1
School type		
Primary	4	2.7
Lower secondary	13	8.8
Upper secondary	130	88.4
Principal gender		
Male	51	34.7
Female	96	65.3
Teacher gender		
Male	710	14.1
Female	4342	85.9

letter from the Kyrgyz MoES. Of the 150 schools, 147 (98%) agreed to participate in our study. To further ensure the representativeness of our sample and to validate the actual demographic distribution, we referenced the official data published by the National Statistical Committee of the Kyrgyz Republic, accessible on their website at http://www.stat.kg/ru.

All teachers and school leaders at the participating schools were invited to participate in the survey via an instant messaging app. The survey was conducted as an anonymous online study in Google Forms. The final sample consisted of $N = 5052$ teachers (response rate: 90%). The participation rate among Kyrgyz school leaders corresponded to the number of schools ($N = 147$). The data were collected online using Google Forms from October 2022 to January 2023, with the support of local coordinators from each of the seven regions and two cities. The coordinators shared the link to the survey through a WhatsApp group with the school leaders of the sampled schools. Subsequently, school leaders were asked to share the link for the teachers' survey with their faculty. Both school leaders and teachers were able to fill out the survey using a computer or mobile device.

Data analysis

Before beginning the analysis of the data, we meticulously screened and cleaned the dataset to prepare it for analysis. This included checking for typos, misspecifications, and missing values. Additionally, since the data was nested by its nature (with teachers nested within schools) and the analysis followed a two-level structural equation model, schools with fewer than 10 responses were deleted from the dataset (Clarke and Wheaton, 2007). The variance inflation factor (VIF < 10) values ranged from 1.5 to 3.01, with a mean average of 1.5, showing no evidence of concern for multicollinearity (Hair et al., 2019). As the amount of missing data was low (6.8%), we applied full information maximum likelihood for all estimations.

The data analysis started with descriptive statistics, including the mean, standard deviation, and correlation among all variables included in the conceptual model. Then, the validity and reliability of each of the main scales were estimated using multilevel confirmatory factor analysis (CFA). Average variance extracted (AVE) and composite reliability (CR) were utilized to estimate the reliability and discriminant and convergent validity (Hair et al., 2019). Moreover, we utilized several fit indices: root mean square error of approximation (RMSEA < 0.08), standardized root mean square residual (SRMR < 0.08), and comparative fit index (CFI > 0.90) (Hu and Bentler, 1998), to assess the fit of the main constructs. We also estimated intra-class correlation (ICC) coefficients; namely, ICC1, or the proportion of variation of a latent construct that is attributed to the group level, with a cut-off of ICC1 > 0.05; and ICC2, or the reliability of a latent construct's school mean, with a cut-off of ICC2 > 0.50 (Koo and Li, 2016).

The final stage of data analysis involved estimating the hypothetical model, using Mplus 8.9 software. Following Lüdtke et al. (2008), we established a doubly-latent multilevel model that controlled for sampling error and measurement error in multiple latent aggregations of level-1 constructs to form multiple level-2 constructs and investigated interactions at both levels, namely whether psychological safety can moderate the relationship between transformational leadership and innovation radicalness at both teacher and school levels. Here, modeling individual climate measures (referring to phenomena at the school level) at both levels is necessary if it can be assumed that individual measures can be influenced by L1 and L2 predictors (Preacher et al., 2010). Furthermore, if the referent of the ratings is at the school level, that is a principal, it would be unreasonable to assume that the unique reality of the teacher providing the rating is the sole cause of that rating (Morin et al., 2023). However, this is not to

say that differences in individual teachers' perceptions are meaningless, but rather that such climate constructs reflect their exposure to a shared within-school reality, and that interindividual variation should be interpreted as such. Thus, these variations reflect either interindividual differences in teachers' levels of exposure to or perceptions of certain work characteristics, and thus cannot be assumed to describe the totality of individual teacher's perceptions of these work characteristics (Marsh et al., 2012; Morin et al., 2022, 2023).

The analysis followed several steps implemented by Morin et al. (2023). Consequently, in our analyses, we assume that objective and subjective perceived characteristics of the work environment lead to similar effects on teacher's innovation radicalness at both the individual and the school level. First, we began the analysis with the null model, which included none of the predictors, to estimate between-school variation in radical classroom innovation. Second, a model without the interaction effect was created to estimate the direct effect of transformational leadership on innovation radicalness and an indirect effect through psychological safety at both the school level and individual teacher levels, using group mean centering. This model also allowed us to estimate how well the model fit the data. Additionally, this model included all teacher- and school-level covariates to control for their variation. Third, we estimated the interaction effect of transformational leadership and psychological safety on innovation radicalness at both levels to estimate the moderation role of psychological safety in the relationship between transformational leadership and innovation radicalness in individual classrooms within schools and classrooms across schools. The Markov Chain Monte Carlo (MCMC) via Gibbs sampling algorithm with 10,000 iterations was used in the final estimation.

Scales and measures

Innovation radicalness (IR) was measured following the OECD's (OECD/Eurostat, 2018) Oslo guidelines for collecting, reporting, and using data on innovation by adopting the design of the European Community Innovation Survey (CIS; Behrens et al., 2017). In doing so, we explicitly focused on IR at the teacher level. Accordingly, we define innovation as something that is new to a teacher and their classroom, but not necessarily new to the school and/or the education sector as a whole (Röhl et al., 2022). This definition does not necessitate that the new process or product is morally superior to existing ones. Rather, it simply requires a notable improvement or substantial change from what was previously employed (Arundel et al., 2019). Following Johannessen et al. (2001), we understand "innovation radicalness" as newness within a unit (teacher/individual classroom). Consequently, radicalness is related to the teacher and is relative to his or her initial situation (before innovating).

In the first step, the teachers were asked by means of a binary coded item (0 = no, was not introduced, 1 = yes, was introduced) whether process innovations affecting their pedagogical work had been introduced in their class in the last 12 months. If teachers answered "yes" to that question, they were asked to indicate how radical this innovation was for them and their teaching on a 10-point ratio scale (from 1 = incremental innovations - improving and/or supplementing and/or adapting what already exists, to 10 = high level of innovation radicalness - introducing something completely new). That means that while a value closer to 1 means more incremental innovation (lower level of innovation radicalness), a value approaching 10 indicates a higher level of innovation radicalness. 20.3% of the teachers surveyed reported that no innovations had been introduced in their classrooms in the last 12 months. In contrast, 79.7% of the surveyed teachers reported that they had introduced such innovations in their classrooms during the last year. Teachers were further

asked to identify the most significant innovations impacting their pedagogical work within the classroom. Among the responses, the most commonly cited examples included the utilization of Information and Communication Technology (ICT), multilingual education methods, the application of formative assessment techniques, and the incorporation of STEM (Science, Technology, Engineering, and Mathematics) education. The reported innovations were regarded as comparatively radical by Kyrgyz teachers for their classrooms ($M = 6.00$, SD $= 3.16$). For our analyses, we re-coded the IR scale to an 11-point scale. If teachers reported that no innovation took place in their classroom during the last 12 months, IR was set to zero, as processes in the classroom remained unchanged from previous conditions. In this respect, the scale has an absolute zero, meaning that a zero score is equal to the absence of innovation radicalness.

Following the definition of Marsh et al. (2012) at the school level this construct represents a formative contextual construct, as the referent is located at the individual level (i.e. the teacher). In this regard, teacher-level ratings are unique and have a theoretically distinct meaning from the school-level context variable (Morin et al., 2022), which presents the composition of IR of a school.

Transformational leadership (TL) was measured through four items from the multifactor leadership questionnaire (MLQ: Bass and Avolio, 1995), indicating idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. An example item is: "My principal helps our schools' teachers to develop their strengths." All items were measured on a four-point scale ranging from "very rarely or never" to "very often." The TL scale's internal consistency was $\omega = 0.907$. Following the definition of Marsh et al. (2012) at the school level this construct represents a reflective climate construct, as the referent is located at the school level (i.e. principal leadership). Thus, the school-level effects of the construct represent a shared, objective picture of transformational leadership, whereas the individual-level effects represent interindividual differences in teachers' exposure to transformational leadership and related differences in individual perceptions (Morin et al., 2022, 2023).

Psychological safety (PS) was measured following Edmondson's (1999) definition, as applied through the short form developed by Fischer and Hüttermann (2020), which we adapted to the Kyrgyz school context. The scale consists of four items rated on a four-point scale, ranging from "totally disagree" to "totally agree." An example item is: "No one in this school would deliberately act in a way that undermines my efforts." The internal consistency of PS scale was $\omega = 0.760$. Although often used as a climate variable, it is not clear to what extent the referent is actually at the school level, as some items also target the individual (see example above). Therefore, a clear classification of the construct as a climate or context construct in the sense of Marsh et al. (2012) is not possible. For a similar discussion about the facet of individual consideration in measuring and modeling transformational leadership, see, for example, Avolio and Bass (1995).

To take into account potential individual and contextual influences we also controlled for teachers' gender, work hours, and teaching experience (both in total and at the present school) at the individual level; while on the scale of schools, we controlled for school level (primary, lower, or upper secondary), school location (village, small town, town, city, large city), school size (i.e. number of students), number of refugee students, school leader gender, and school leader experience (both in total and at the present school).

Results

The results of descriptive statistics (mean, standard deviation, and Pearson correlations) are shown in Table 2. The mean values for the two constructs were relatively high on the 4-point Likert-type

Table 2. Descriptive statistics of and correlations among variables used in the conceptual model.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 T-gender	–														
2 T-teaching exp this school	0.023	–													
3 T-teaching exp before	0.026	–0.011	–												
4 T-work hours	0.010	0.018	0.022	–											
5 School location	0.066**	–0.034*	0.067**	–0.006	–										
6 School level	–0.021	0.009	0.003	0.006	0.025	–									
7 School size	0.022	–0.066**	0.078**	0.009	0.446**	0.129**	–								
8 Percentage of refugee	–0.016	0.000	–0.012	0.080**	0.047**	–0.036*	0.010	–							
9 P-gender	–0.003	–0.025	0.038**	0.035*	0.083**	–0.090**	0.037**	0.129**	–						
10 P-total experience	–0.019	–0.001	–0.015	–0.023	–0.151**	0.018	–0.124**	–0.400**	–0.045**	–					
11 P-experience this school	–0.021	–0.021	0.001	0.051**	0.158**	0.067**	0.065**	–0.017	0.073**	0.328**	–				
12 P-teaching experience	–0.041***	0.031*	–0.022	0.029*	–0.294**	–0.059**	–0.111**	–0.030*	0.106**	–0.036*	–0.010	–			
13 IR	0.012	0.046**	0.021	–0.035*	0.004	–0.008	0.023	0.002	–0.009	0.008	–0.017	–0.015	–		
14 TL	0.018	–0.043**	0.015	0.015	–0.003	–0.031*	0.030*	0.027	0.034*	0.003	–0.020	0.024	0.068**	–	
15 PS	–0.033*	0.013	0.014	0.049**	–0.011	0.030*	0.031*	–0.014	0.013	0.002	–0.010	0.029*	0.049**	0.378**	–
Mean	–	13.31	4.72	24.37	–	–	576	.15	–	7.60	5.70	15.15	6.00	3.31	2.98
SD	–	12.08	8.00	14.87	–	–	559	.66	–	7.00	5.39	9.02	3.16	.712	.808
Min	1	0	0	0	1	2	58	0	1	–	0	0	0	1	1
Max	2	53	50	120	5	4	3200	4	2	46	25	40	10	4	4

Note: n = 4709, IR = innovation radicalness, TL = transformational leadership, PS = psychological safety.
* p < 0.05, ** p < 0.01, *** p < 0.001.

scales: 3.31 for TL and 2.98 for PS. It was also relatively high on the 11-point scale: 6.00 for IR. This suggests that despite the prevalent top-down management approach within the Kyrgyzstani education system, teachers report experiencing a relatively high level of transformational leadership from their principals. This may initially appear contradictory; however, it underscores the nuanced dynamics of educational leadership and innovation in contexts dominated by traditional management styles as observed in post-soviet countries. School leaders are—to some degree—merely performing compliance with instructions from educational management officials. School management and activities in schools may often differ from what is being reported. In conjunction with limited actual oversight of activities in schools (a challenge in its own right), school leaders are awarded a degree of autonomy higher than that intended by the educational system.

The correlation results showed a significant and positive correlation among all main constructs in the conceptual model. The correlation between TL and PS was moderate and significant ($r = 0.378$, $p < 0.01$). In addition, the correlation between IR and PS ($r = 0.049$, $p < 0.01$) and between IR and TL ($r = 0.068$, $p < 0.01$) were small but significant.

The validity and reliability values of the scales used in this research were then estimated (Table 3). The results indicated that all Cronbach's alpha (>0.70), AVE (>0.50), and CR (>0.70) for both TL and PS are above the suggested threshold (Hair et al., 2019). In addition, ICC1 and ICC2 values for both constructs were above 0.050 and 0.50, respectively (Koo and Li, 2016). Finally, the CFA results (Table 3) show evidence of a good fit of the constructs employed in the hypothetical model, with an RMSEA value of TL being slightly larger than 0.090. To test for isomorphism, we followed Morin et al. (2022, 2023) and thus estimated two two-level CFAs for each latent variable, one without and one with fixed parameters (i.e. assuming equality of the factor loadings across L1 and L2). For both TL (RMSEA = 0.091, TLI = 0.948, CFI = 0.983, SRMRw = 0.020, and SRMRb = 0.004) and PS (RMSEA = 0.070, TLI = 0.907, CFI = 0.969, SRMRw = 0.026, and SRMRb = 0.018), the unrestricted measurement model fit the data well. After constraining the construct indicators to be invariant across levels, the invariant measurement models continued to fit the data well and, consequently, showed little or no decrement in the fit indices for TL (RMSEA = 0.074, TLI = 0.965, CFI = 0.980, SRMRw = 0.021, and SRMRb = 0.088) and PS (RMSEA = 0.050, TLI = 0.952, CFI = 0.972, SRMRw = 0.026, and SRMRb = 0.034). We noticed, however, that the SRMRb changed significantly. However, this is not surprising as our sample size on L2 is below 200 (Asparouhov and Muthén, 2018) and the performance of SRMRb depends on ICC values (Hsu et al., 2015). This leads Hsu et al. (2015) to state that the RMSEb is "not recommended for evaluating model fit, especially under low ICC conditions" (ICC1 < 0.09), which is true for our measurement models. Accordingly, the analyses revealed a

Table 3. Reliability, fit indices, and ICC.

	alpha	AVEw	AVEb	CRw	CRb	RMSEA	CFI	SRMRw	SRMRb	ICC1	ICC2
TL	0.907	0.851	0.999	0.958	1.00	0.091	0.991	0.020	0.004	0.096	0.789
PS	0.760	0.667	0.985	0.888	0.996	0.070	0.984	0.026	0.018	0.084	0.756
IR										0.058	0.676

Note: PS = psychological safety, TL = transformational leadership, IR = innovation radicalness, AVE = average variance extracted, CR = composite reliability, RMSEA = root mean square error of approximation, CFI = comparative fit index, SRMR = standardized root mean square residual value, ICC = intra-class correlation coefficient.

good model fit of both measurement models and cross-level isomorphism for TL and PS (Marsh et al., 2012).

Regarding our hypothetical model, the first model tested was a two-level null model where IR in the classroom was the outcome variable and none of the predictors were included in the model. The result shows an intra-class correlation (ICC1) value of 0.058, which is slightly larger than the recommended threshold of 0.05. This is an indication that 5.8% of the total variance in IR in the classroom can be attributed to between-school differences. The reliability of the construct's school mean (ICC2) was 0.676. In sum, the null model showed that the multilevel model is warranted.

The second model was a fixed effect model where direct relationships between TL and IR and their indirect associations via PS, along with all other level-2 and level-1 covariates, were added to the model. The fit statistics indicated evidence of a good fit (RMSEA = 0.027, TLI = 0.960, CFI = 0.967, SRMRw = 0.032, and SRMRb = 0.082). The results indicated that at the individual level, teachers' total teaching experience ($B = 0.022$, $p < 0.001$) and experience in their present schools ($B = 0.032$, $p < 0.001$) are significantly related to their perception of IR in their classroom. This implies that those who have more experience in general and more experience in their current schools are more likely to engage in higher IR practices in classrooms. Gender and teacher work hours were not significantly associated with IR ($p > 0.10$). At the school level, among all covariates, only school type was significantly related to IR. We found that teachers at both upper secondary ($B = 0.711$, $p < 0.05$) and lower secondary schools ($B = 1.105$, $p < 0.01$) were on average more likely to implement IR in their classrooms compared to teachers in primary schools who were prone to relatively lower IR. None of the other school-level variables (school location, school size, number of refugee students, and school leader gender and experience) were significantly associated with IR in schools.

In terms of the effect of the main constructs, the results of this model (2) (shown in Table 4) enabled us to test our hypotheses. Following the order of our hypotheses, the results indicated a significant relationship between TL and IR composition ($B = 0.574$, $p < 0.001$) at the teacher level. Similarly, the association between TL and IR at the school level is also significant ($B = 1.735$, $p < 0.05$). Accordingly, we confirmed our hypothesis H1 regarding IR, indicating that stronger TL is associated with higher IR. However, a direct association between PS and IR was only evident at the individual level ($B = 0.475$, $p < 0.001$). That is, the relationship between school-level PS and IR was not significant ($p > 0.05$). This means that while an increase in perceived individual PS is associated with higher individual IR in classrooms, such an increase does not lead to a significant increase in IR across schools. Moreover, we found supporting evidence to confirm H3—that is, there was a direct and significant relationship between TL and PS ($B = 0.544$, $p < 0.001$) at the individual level as well as at the school level ($B = 0.570$, $p < 0.001$). This indicates that on average the more TL school leaders enact, the more teachers individually and as a group in a school feel safe. Finally, we examined the indirect relationship between TL and IR through PS and found supporting evidence only at the individual level ($B = 0.259$, $p < 0.001$) since there was not a direct association between PS and IR at the school level ($p > 0.05$) (see Figure 2).

The third model (Table 2) examines the moderation role of PS in the relationship between TL and IR among individual teachers and across schools. The coefficient was positive and significant at both the teacher level ($B = 2.222$, $p < 0.001$) and school level ($B = 3.666$, $p < 0.05$), showing evidence of the positive moderation role of PS within and across schools. This means that the relationship between TL and IR in individual classrooms becomes stronger by 2.222 units as an

Table 4. MSEM estimates, standard errors, and confidence intervals for model 1 and model 2.

| | Construct | Coefficient | | 95% Confidence Interval | | |
		Estimate	SE	Lower	Upper	p-Value
	Direct effects (*Within*)					
	Gender (*Ref = male*) → IR	0.046	0.167	−0.281	0.372	0.783
	Teaching Experience (this school) → IR	0.032	0.005	0.023	0.042	0.000
	Teaching Experience (total) → IR	0.022	0.006	0.010	0.034	0.000
	Teacher work hours → IR	0.003	0.004	−0.006	0.012	0.473
	TL → PS	0.544	0.028	0.489	0.600	0.000
	TL → IR	0.574	0.128	0.322	0.825	0.000
	PS → IR	0.475	0.131	0.217	0.732	0.000
Model 2	Direct effects (*Between*)					
	Lower Secondary (Ref = Primary) → IR	1.105	0.322	0.473	1.737	0.001
	Upper Secondary (Ref = Primary) → IR	0.711	0.294	0.135	1.286	0.015
	Small town (*Ref = village*) → IR	−0.015	0.325	−0.651	0.621	0.963
	Town (*Ref = village*) → IR	0.322	0.230	−0.129	0.773	0.162
	City (*Ref = village*) → IR	−0.515	0.513	−1.520	0.490	0.315
	Large city (*Ref = village*) → IR	−0.392	0.402	−1.181	0.396	0.330
	Principal Gender (*Ref = male*) → IR	−0.220	0.167	−0.548	0.107	0.187
	Total Principalship Experience → IR	−0.002	0.016	−0.030	0.034	0.923
	Principalship Experience in this school → IR	−0.005	0.020	−0.044	0.034	0.803
	Principal Teaching Experience → IR	0.004	0.010	−0.015	0.024	0.682
	Number of Students → IR	0.000	0.000	0.000	0.001	0.549
	Percentage of refugee students → IR	−0.224	0.146	−0.510	0.062	0.124
	PS → IR	1.423	0.861	−0.265	3.110	0.098
	TL → IR	1.735	0.687	0.389	3.082	0.012
	TL → PS	0.570	0.093	0.389	0.752	0.000
	Indirect effects (*within*)					
	TL → PS → IR	0.259	0.120	0.116	0.401	0.000
	Indirect effects (*between*)					
	TL → PS → IR	0.812	0.232	−0.215	1.838	0.121
	Total effects (*within*)					
	TL → IR	0.832	0.120	0.598	1.067	0.000
	Total effects (*between*)					
	TL → IR	2.547	0.509	1.550	3.544	0.000
Model 3	Interaction (*within*)					
	TL × PS → IR	2.222	0.598	0.122	7.210	0.000
	Interaction (*between*)					
	TL × PS → IR	3.666	1.808	1.051	3.394	0.043

PS = psychological safety, TL = transformational leadership, IR = innovation radicalness, SE = standard error.

individual's PS increases by one unit. More specifically, TL is more strongly related to IR in classrooms in schools with more PS, when compared to teachers with less PS who then tend to be less radical in innovation. Similarly, considering the school-level interaction effect, the results mean that TL is more strongly related to IR in classrooms at schools with more PS among teachers when compared to schools with less PS among teachers who then tend to be overall less radical in innovation. The results, therefore, support hypothesis H5.
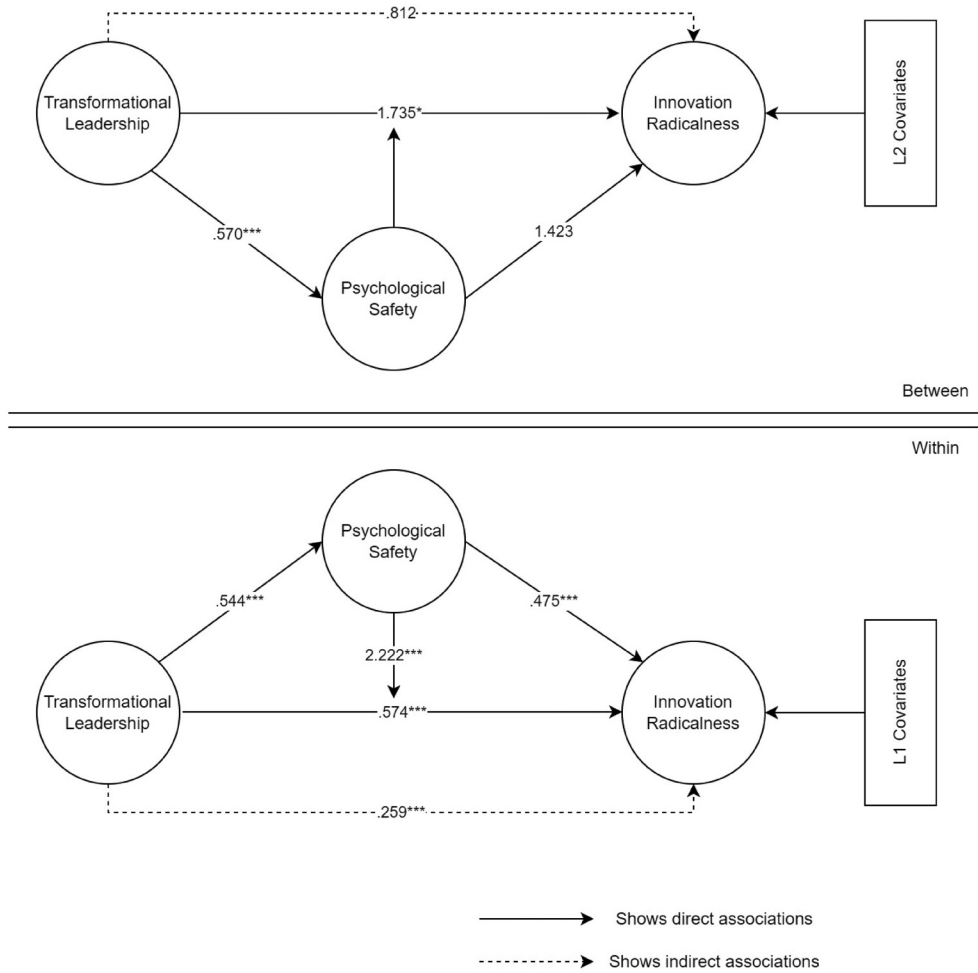
Figure 2. Results of the hypothetical model.

Discussion

Our analysis indicated that transformational school leadership is significantly related to higher innovation radicalness in classrooms, suggesting that by enacting transformational leadership practices, school leaders can positively influence higher innovation radicalness in Kyrgyz classrooms. This concurs with previous studies indicating that transformational leadership has strong potential to foster an innovative school climate and teacher capacity for innovation (Waruwu et al., 2020), leading them to gain advantages from either better teaching (Moolenaar et al., 2010) or more frequent innovative pedagogical practices (Supermane, 2019). While supporting the findings of past literature on school innovation, we also add to this scholarship by generating evidence that with increased transformational leadership in schools, teachers are not only more innovative but also more radical in their innovative practices in Kyrgyzstan where top-down management dominates

the education and school systems. More specifically, teachers are more likely to introduce new pedagogical strategies in classrooms (Forés and Camisón, 2016; Norman and Verganti, 2014) when they are supported by a school leader who promotes shared goals among teachers, attends to individual teachers' needs (Leithwood and Jantzi, 2000), encourages teachers to produce original ideas (Bass et al., 2003), and communicates high expectations (Hallinger, 2003). By contrast, lower innovation radicalness could be possible through the enactment of relatively weaker transformational leadership.

Our analysis indicated that overall, the associations of the model variables behave similarly at both teacher and school levels, except for an insignificant mediation effect of psychological safety at the school level. This result emanates from the lack of a significant link between psychological safety and innovation radicalness across schools. This means that psychological safety has a more complex effect at the individual level than at the collective level. When a teacher experiences or perceives such safety, this reinforces the effect that the transformational leadership he or she perceives has on his or her willingness to implement (more) radical innovations in the classroom. Yet, such an effect was not the case when considering the collective effect of psychological safety. The lack of the effect of psychological safety at the school level could be explained by a limited level of between-group variability (Morin et al., 2023). Only a small proportion of the total variation in innovation radicalness could be attributed to school-level variables (ICC1 = 0.058), a large proportion of which was accounted for by the differences in transformational leadership between schools. The centralized nature of the education system in Kyrgyzstan might be the main element in reducing the diversity in innovation radicalness in teacher practices across different schools (Sindhvad et al., 2020).

Our findings indicate that a sense of psychological safety could make an important contribution to individual teachers' innovative practices by strengthening the influence of school leaders on a higher innovation radicalness of individual classroom pedagogies. While school leaders' engagement in transformational practices has already been proven to be important for innovation (Moolenaar et al., 2010; Supermane, 2019), we found that such leadership practices could lead to less radical when teachers' sense of safety is weak since innovation is associated with high risk and uncertainty (Norman and Verganti, 2014). This result is also confirmed by recent research conducted in Chinese schools, though that work focused specifically on moral leadership (Chen et al., 2022). When school leaders emphasize innovation in pedagogical strategies, teachers' perception of shared safety derived from mutual trust and respect allows for risk-taking, which is a critical antecedent of innovation radicalness (Newman et al., 2017). Therefore, cultivating psychological safety among teachers emerges as an indispensable element for the initiatives undertaken by school leaders to promote the use of higher innovation radicalness in pedagogical strategies and techniques. This result is particularly important for the Kyrgyz schools and the education system, which is supported by international organizations through various projects and pilots to enhance the adoption of innovative techniques. Our findings suggest that transformational school leadership could help bolster the longevity of this innovation initiative considering the potential discontinuation of such external funds and supports. Therefore, Kyrgyz leaders who can cater to teachers' unique needs and cultivate a culture of safety and innovation play a crucial role in preserving innovative pedagogies beyond just the pilot phase.

While the present research emphasizes the necessity for establishing psychologically safe teacher teams in schools, it also gives clues for how to succeed in such endeavors. For instance, our research found a positive association between transformational leadership and psychological safety. This means that while psychological safety can play an essential role in supporting

transformational leadership to influence higher innovation radicalness in teachers' pedagogical practices, transformational leadership itself can help in the development of psychologically safe teachers. The positive impact that this type of leadership has on team safety has also been noted by previous researchers from other fields (Zaman and Abbasi, 2020), and the present study provides initial evidence that it can also be applied to educational contexts. This finding can be attributed to the individual consideration and inspirational motivation aspects of transformational leadership, suggesting that school leaders recognizing and addressing the needs of teachers, providing personalized support, and creating a shared vision among teachers might help reduce the pernicious outcomes of risk and vulnerability and hence support a safer school climate for innovation (Moolenaar et al., 2010).

Limitations and future research

Three main limitations should be highlighted before drawing conclusions from this study. First, the data were collected from Kyrgyzstan, a country with almost no previous research on school leadership. Therefore, there is no chance to compare the findings here with other research in the same context. More research on Kyrgyz schools is needed to capture the nature of school leadership and its impact on teachers and students in this Central Asian nation. Second, our focus in the present study is on the innovation radicalness of classroom pedagogies and hence the results imply the influence of transformational school leadership on only individual teachers. Additional research is needed to make a conclusion about how principals' leadership might influence school-level innovation radicalness. As we find that school leadership influences teacher's individual innovation radicalness, the concept of micro-foundations (Dedering and Pietsch, 2023) seems particularly promising here, as it allows us "to understand how individual-level factors impact organizations, how the interaction of individuals leads to emergent, collective, and organization-level outcomes and performance, and how relations between macro variables are mediated by micro-actions and interactions" (Felin et al., 2015: 576). Finally, our data are cross-sectional and the link among variables does not show any causal effects; rather, they demonstrate an association. Replicating this study with a longitudinal dataset could enable researchers to make causal inferences regarding the effect of transformational school leadership on innovation radicalness in classroom pedagogies.

Conclusion and implications

This research has three main contributions to the existing knowledge base in educational leadership. First, it contributes to the growing international endeavors to provide insight into how school leaders influence teachers and their teaching practices (Moolenaar et al., 2010). There has been a relatively well-established argument that school leadership is associated with improvements in teacher learning and instructional practices. The present research brings a new perspective to this literature by indicating that transformational school leadership can play a significant role in triggering more radically innovative teaching practices, by pointing to those that are either new or require higher innovation radicalness. We therefore conclude that a greater focus on transformational leadership is needed to influence higher innovation radicalness in the classroom, which could potentially address the varied needs of students in a rapidly diversifying world.

Second, this work contributes to the theory of transformational leadership by indicating that the impact of such leadership on innovation radicalness can be reinforced through the availability of psychological safety among the members of an organization. This theory focuses on innovation

in organizations, which is associated with high ambiguity, risk, stress, and consequently resistance. We suggest that transformational leadership itself could be a supportive mechanism for establishing a more psychologically safe climate. Beyond that, we also emphasize that when transformational leadership interacts with psychological safety, the effect of leadership on innovation, particularly a more radical one, is boosted. In the field of education, this led us to conclude that school leaders should prioritize the emotional state of teachers characterized by psychological safety by acting as transformational leaders to enhance the impact of their practices on the realization of increased innovation radicalness in teaching.

Third, this study contributes to growing international knowledge about educational leadership and its impact in developing non-western countries by bringing evidence from Kyrgyzstan. The implications of this study are significant for the education system in Kyrgyzstan and other countries facing similar challenges, such as a highly centralized school governance system and the lack of a professional culture for educational management. Therefore, our study provides potential guidance for the professional development of school leaders, with a focus on transformational leadership practices. These practices include promoting inspirational motivation, intellectual stimulation, and individualized consideration, which can foster interpersonal trust and the freedom to take risks and experiment within a school. By adopting these practices, school leaders can drive innovation and cultivate an environment that facilitates effective and innovative teaching and learning activities.

Declaration of conflicting interests

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Supplemental material

Supplemental material for this article is available online.

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