

Measuring teacher entrepreneurial behavior: a scale development and validation study

Journal of
Professional
Capital and
Community

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Received 18 January 2024
Revised 25 April 2024
Accepted 10 May 2024

Abstract

Purpose – This study aims to develop and validate a scale to measure Teacher Entrepreneurial Behavior (TEB), which encapsulates the behaviors teachers employ to identify and amplify innovation in schools. TEB are catalysts for innovation, navigating their peers through risks and building trust, which empowers the collective to transcend structural constraints and pioneer new educational initiatives. Despite the importance of TEB, there is a notable absence of a well-validated measurement instrument.

Design/methodology/approach – Drawing on existing empirical TEB studies, this study conducts four interconnected studies following scale-development procedures. The content validity, construct validity, internal consistency, and external validity of the proposed scale were assessed using exploratory factor analysis, confirmatory factor analysis, invariance analysis, and regression analysis.

Findings – The result is a multidimensional TEB model featuring 15 items with a good model fit. The TEB scale comprises four factors: Advocating Innovation, Seeking Resources, Cultivating Cohesiveness, and Mitigating Risk.

Originality/value – This study represents a rigorous attempt to develop and validate a reliable instrument for measuring TEB. It provides a validated tool for future research aimed at understanding the nature of TEB as an independent construct and associated dynamics. Accurate measurement is important for the robustness and replicability of research. Furthermore, the insights gained on TEB scale can significantly inform both the preparation and evaluation of teacher leaders by emphasizing the importance of entrepreneurial behaviors in promoting teachers' collaboration and actualizing innovative initiative.

Keywords Innovation, Scale development, Teacher leaders, School change, Teacher entrepreneurial behavior

Paper type Research paper

Introduction

Schools encounter resistance to transformative change, as entrenched power structures and the conservative nature of schooling favors compartmentalization of knowledge and perpetuates conventional frameworks (Hargreaves, 2022). Despite the profound resistance, the educational terrain is gradually shifting, along with policy directives, prompting a reevaluation of the teacher's role. Educators, particularly those in the middle tier, are increasingly called upon to exercise initiative and creativity in responding to complex educational changes (Hargreaves and Shirley, 2021; Hargreaves, 2022). These teachers lead change initiatives grounded in their expertise and localized needs, supplementing model of top-down implementation of change (Hargreaves and Shirley, 2020).

In response to this, studies on Teacher Entrepreneurial Behavior (TEB) have emerged as an important lens to provide critical insights into how teachers collaboratively engage with peers and leaders, navigating risks and cultivating trust to jointly drive change in schools



(Neto *et al.*, 2017; Oplatka, 2014; Van Dam *et al.*, 2010). TEB encompasses a series of competencies and attributes that enable teachers to be sensitive to new ideas within their school context and seize opportunities to actualize and scale up innovation (Borasi and Finningan, 2010; Ho *et al.*, 2021). Studies have observed that entrepreneurial teachers exhibit their shared commitment and abilities amidst the innovation process to their peers and leaders (Davis, 2023; Oplatka, 2014). This engenders a supportive environment that encourages teachers to embrace risk and extend beyond their conventional boundaries, thereby facilitating the advancement of innovative practices within their schools (Ho *et al.*, 2020; Kasim, 2021).

The literature on TEB has seen considerable growth since Eyal *et al.*'s seminal work in 2003, which synthesized prior qualitative studies on school principals' entrepreneurship and underscored the importance of understanding and measuring entrepreneurial activities in schools. Despite this growing interest in TEB, subsequent research has encountered some challenges. In their recent reviews of TEB, both Keyhani and Kim (2020) and Ho *et al.* (2021) noted a dominance of qualitative methodology, which may be partly attributable to the lack of quantitative instruments for assessing TEB. This methodological limitation could potentially impede the further development of TEB research.

Indeed, regarding quantitative studies on TEB, various instruments have been employed across ten studies (as summarized in Appendix). Several researchers, including Chawla and Lenka (2015), Kasim and Zakaria (2019), and Neto *et al.* (2017, 2018, 2019, 2020), have repurposed instruments originally developed for business entrepreneurial literature to explore entrepreneurial behavior within an educational context. However, a robust conceptual foundation, anchored in comprehensive literature, is important for instrument validity, ensuring that the measures accurately reflect the targeted constructs (AERA *et al.*, 2014). Furthermore, this theoretical grounding is essential for the straightforward interpretation of results, facilitating meaningful insights consistent with established theories (Messick, 1995). Entrepreneurial behavior in educational contexts differs from entrepreneurial behavior in business contexts in at least two ways. Teachers are often motivated by the desire to create social value rather than economic value (Chand, 2014; Keyhani and Kim, 2020), and they operate within the unique constraints of an educational system (Ho *et al.*, 2021). These distinctions underscore the need for a well-validated TEB measure grounded in a synthesized conceptual TEB framework.

Van Dam *et al.* (2010) have made a noteworthy progress in creating a competency-based TEB framework. However, it was developed without a preceding in-depth conceptualization of TEB and leaned on the notion of corporate entrepreneurship to interpret the essence of TEB. They incorporated instrument from corporate entrepreneurship literature (refer to Schyns and Von Collani, 2002) and adolescent literature (refer to Strom *et al.*, 1999) to structure the framework. This scale was the first of its kind that delved into teacher entrepreneurial behavior by taking into account school context, however, the process of how the scale was developed was not transparent, and the scales' measurement qualities was not established either. Furthermore, Neto *et al.* (2020) extended Van Dam *et al.*'s work by adapting their instrument, yet they did so without deeply examining the specific competencies and attributes that define TEB. Although well-intentioned, this respectful adaptation could affect the instrument's validity and relevance. The absence of such a measure not only hinders research progress on TEB but also threatens the validity of findings relating to TEB. As TEB is intimately associated with collaborative efforts to ignite school-wide innovation (Oplatka, 2014), developing a scale is also important to deepen our understanding of TEB's role in cultivating an innovative culture and facilitating collective change within schools. To fill this gap, we aim to develop a valid TEB scale by drawing on the most recent advances in TEB conceptualization by following scale development steps.

Theoretical framework

The term “entrepreneurship” traditionally describes how individuals embrace innovation, assume corresponding risks, and turn ideas into new products, services, or businesses (Kurniawan *et al.*, 2017). In education, market-driven reforms have underscored the importance of teachers’ autonomy and agency, prompting teachers to reimagine their professional identity to navigate the rapid changes (Stone-Johnson, 2017). In response to this, TEB has emerged as a critical concept that captures teachers’ new role in the backdrop of this evolution (Wilkins *et al.*, 2021). Teachers are at the forefront of trialing and evaluating innovative practices and exercising entrepreneurial capacities to drive educational innovation (Oplatka, 2014).

A resurging body of literature has been exploring what constitutes TEB, defined as a unique set of attributes and competencies that teachers manifest in order to identify and actualize innovative opportunities within educational environments (Ho *et al.*, 2021; Davis, 2023; Oplatka, 2014). Teachers who demonstrate TEB are dynamic leaders and community builders who initiate and sustain transformative changes within their schools’ culture and practice (Hayat and Amer, 2015). Far from being solitary figures, these educators foster collaborative environments, building trust and working alongside colleagues to expand innovative methods across the school’s academic and administrative spheres (Ho *et al.*, 2020). By spearheading collective efforts, they help to weave a fabric of shared responsibility and mutual support, enabling the integration of innovative methods throughout the school’s academic and administrative realms (Ho *et al.*, 2020; Eyal and Yosef-Hassidim, 2012).

Since Eyal and Inbar (2003) introduced the concept of educational entrepreneurship, empirical studies have consistently identified a cluster of behaviors exhibited by entrepreneurial teachers. These behaviors demonstrate an evolution in a teacher’s entrepreneurial competencies and attributes across instructional, leadership, managerial, and administrative domains (Chawla and Lenka, 2015; Davis, 2023; Ho *et al.*, 2021; Martin *et al.*, 2018).

In their systematic review, Ho *et al.* (2021) investigated the multifaceted concept of TEB, engaging with a broad spectrum of studies from the United States, Europe, Asia, Africa, and other regions, sourced from the Web of Science and Scopus databases. Their analysis yielded five central clusters of TEB: innovation, risk-taking, autonomy, managerial skills, and seeking external resources. This inclusive approach allowed scholars to capture the nuances of the TEB construct across varied cultural and educational contexts, thereby enriching the understanding of its universal and context-specific aspects. Subsequent cross-case studies further refined these characteristics, leading to a more precise conceptualization of TEB within a different school setting. These behaviors include coordinating efforts, seeking resources, advocating for innovation, displaying ownership and enthusiasm, embracing risk-taking, and balancing humility with confidence. The study highlights that these behaviors are explicit manifestations of the competencies and attributes of entrepreneurial teachers. TEB is a set of explicit competencies and attributes that enable entrepreneurial teachers and their teams to reflect upon and enhance their practices.

This study is grounded in Ho *et al.*’s theoretical framework (2021) for crafting an instrument to assess TEB. This framework pinpoints six subdomains of TEB for measurement, including three competencies and three attributes, ensuring that the TEB scale is contextually relevant and adequate to the educational landscape. Additionally, it underpins the construct validity of the scale, guaranteeing that the items accurately capture the intended entrepreneurial attributes of teachers.

Coordinating effort was primarily associated with managing resources and planning for action, predominantly aimed at ensuring the quality of work outcomes (Borasi and Finningan, 2010; Van Dam *et al.*, 2010; Weber *et al.*, 2013). However, recent studies have broadened this understanding that entrepreneurial teachers provide clear direction and

strategies for their colleagues, engaging in interactive communication with the entire team (Juwita, 2019; Kasim and Zakaria, 2019). They also catalyze reflective thinking through coordination and problem-solving activities, fostering an environment where experiences and strategies are shared to address pressing challenges in implementation (Ho, 2023; Davis, 2023). This competency helps entrepreneurial teachers to gain trust from fellow teachers through reliable performance and high job satisfaction, which in turn boosts team spirit in actualizing innovative initiatives.

Advocating innovation, involves stimulating and capitalizing on the creative potential of teaching colleagues and introducing innovative ideas into the organization to enhance its innovation capability (Ho *et al.*, 2021; Eyal and Yosef-Hassidim, 2012; Oplatka, 2014). Entrepreneurial teachers maintain awareness of new policy initiatives and educational trends, seeking inspiration from emerging teaching and learning possibilities (Borasi and Finningan, 2010; Hayat and Amer, 2015; Kasim and Zakaria, 2019). They contextualize these new ideas in their teaching addressing the dual needs of the students and the school. Adopting new teaching strategies and learning through trial and error, these teachers refine their practices based on experience and actively share their insights with peers (Chand, 2014; Martin *et al.*, 2018). They serve as role models to share and cooperate among colleagues (Kasim and Zakaria, 2019).

Seeking resources involves pursuing, accumulating, and utilizing both internal and external resources to facilitate the realization of innovations (Chand, 2014). Given the novelty of innovation within school settings, entrepreneurial teachers often face budgetary constraints, which, while limiting, can also stimulate creative solutions for supporting innovation (Ho, 2023). They seek both monetary and personal support from school leaders (Borasi and Finningan, 2010; Van Dam *et al.*, 2010). They also strategically network with external entities like universities and businesses, accessing diverse resources to broaden their capacity to initiate change (Chand, 2014; Eyal and Yarm, 2018).

Ownership-enthusiasm refers to their profound commitment and passion towards innovative ideas, coupled with a persistent drive to overcome obstacles (Eyal and Yosef-Hassidim, 2012; Ho *et al.*, 2021; Juwita, 2019). Earlier literature often conceptualized this attribute as “proactiveness,” characterized by teachers’ initiative to complete assigned tasks diligently (Van Dam *et al.*, 2010; Hayat and Amer, 2015; Weber *et al.*, 2013). Recent studies have broadened this understanding (Ho *et al.*, 2021; Juwita, 2019) that entrepreneurial teachers exhibit a sense of educational calling and emotional commitment to initiating and executing innovations (ownership). As teachers emphasize the project and students as their own “baby”, they willingly invest personal time and resources to develop and implement innovative programs that cater more effectively to students’ needs (enthusiasm). On top of demonstrating proactiveness, entrepreneurial teachers own the new initiative and take care of it enthusiastically.

Risk-taking represents entrepreneurial teachers’ willingness to experiment with new and unfamiliar alternatives amidst uncertainty (Kurniawan *et al.*, 2017; Van Dam *et al.*, 2010). However, risk-taking in educational settings should not be equated with uncalculated gambling that could jeopardize the school and its students (Ho, 2023; Neto *et al.*, 2017). Instead, entrepreneurial teachers are observed to manage risks systematically and actively. For instance, they often conduct pilot testing before scaling up innovative practices (Hayat and Amer, 2015; Ho *et al.*, 2021; Neto *et al.*, 2019). They undertake and own the risks they promote, thereby providing their colleagues with convincing evidence of the feasibility of their innovative improvements. Entrepreneurial teachers do not merely bear all the uncertainty; in fact, they take calculated risks while also minimizing them.

Humility-confidence refers to the balance of demonstrating confidence in professional judgment and expressing humble appreciation of colleagues’ contributions throughout the implementation process (Ho *et al.*, 2021; Kasim, 2021; Joensuu-Salo *et al.*, 2020).

Entrepreneurial teachers exhibit genuine care for their colleagues' feelings and confidently persuade them to participate in their initiatives (Ho *et al.*, 2021; Ho, 2023; Joensuu-Salo *et al.*, 2020). Simultaneously, they possess high self-efficacy, effectively persuading their colleagues through social interactions (Kasim, 2021; Martin *et al.*, 2018). When their innovative ideas are questioned or challenged, entrepreneurial teachers defend their approaches with a blend of humility and firmness (Ho *et al.*, 2021; Joensuu-Salo *et al.*, 2020; Martin *et al.*, 2018).

The theoretical framework has revealed that each entrepreneurial behavior manifests in a uniquely nuanced manner within school contexts. These behaviors deepen our comprehension of the professional teacher's role when pursuing entrepreneurial goals and delineate the ways in which entrepreneurial teachers foster an innovative community at their schools (Ho, 2023). While substantial progress has been made in conceptualizing TEB, the field currently lacks robust instruments for quantifying these behaviors. The development of such measurement tools, therefore, represents a critical milestone in the ongoing evolution of TEB research.

Method

Overview of scale-development procedures

In developing the scale, we followed the steps recommended in the organizational development research literature (AERA *et al.*, 2014; Hinkin, 1998). First, we began with item generation. Based on a thorough literature review, we revisited an interview dataset from a large project on teacher entrepreneurial behavior. Using themes derived from the literature and interview data, we identified an initial pool of 28 items representing the 6-dimensional conceptual domain of TEB. We then moved to assess the content validity with the help of four subject-matter experts, and expanded the initial 28 items into 29 items. Second step is item reduction through exploratory factor analysis (EFA). We applied EFA to the 29-item scale, reducing items based on factor loadings and conceptual relevance. To further verify construct validity, we invited a construct development expert to review the items. A third step is confirmatory factor analysis (CFA) that can provide further evidence of internal consistency, reliability and content validity of the new measure. In the final step, we conducted correlation analysis and CFA to provide the convergent and discriminant evidence. Hierarchical linear modeling (Raudenbush, 2004) was also used to assess whether the dimensions of TEB can explain the variance in theoretically deemed outcomes (Predictive validity). The flow of scale development is summarized in Table 1.

Study 1 – item generation and content validity

The purpose of this step was to develop a pool of survey items that: (1) span the six dimensions of TEB identified through the literature review; (2) are easily understandable to teachers; and (3) contain at least four to six items per dimension to allow for the estimation of internal consistency and reliability (Ponterotto and Ruckdeschel, 2007).

Sample. Considering the proposed six-dimensional framework of TEB, we re-examined interview data gathered from 23 teachers and eight school leaders across four secondary and four primary schools. These participants were involved in projects aimed at conceptualizing teacher entrepreneurial behaviors. Recognized for teaching excellence, they have introduced explorative innovations into their schools, scaling these up across various subjects.

Procedure and results. We revisited the semi-structured interview data to identify participants' perceptions of their entrepreneurial behaviors during the actualization of innovation. Examples were provided to underscore the prominence of these behaviors. In concordance with the theoretical framework of TEB, we generated 28 raw items, each representing one of the intended six dimensions of the TEB scales. To enhance the relevance

Study	Action and variables	Data/sample
Study 1	<ul style="list-style-type: none"> - Review empirical studies - Review practitioners' document - Peer review - Experts review - Generate 29 items 	Empirical studies <ul style="list-style-type: none"> - 23 entrepreneurial behavior studies Practitioners' documents <ul style="list-style-type: none"> - Teachers and School Leaders as Lifelong Learners (OECD, 2019) - Teacher competence framework (Education Bureau, 2003) - T-standard+ (The Education Bureau, 2020) Reviews <ul style="list-style-type: none"> - Two authors - Two entrepreneurship scholar
Study 2	<ul style="list-style-type: none"> - Initial pool = 29 items - Item reduction to 15 items using EFA and construct development expert 	N = 211 teachers (six schools) 70 (33.18%) men Teaching experience <ul style="list-style-type: none"> - 0-3 years: 42 (19.91%) teachers - 4-7 years: 38 (18.01%) teachers - 8-11 years: 33 (15.64%) teachers - 12 or above: 97 (45.97%) teachers Formal teacher leaders: 111(52.61%) teachers
Study 3	<ul style="list-style-type: none"> - Initial pool = 15 items - Maintain 15 items using EFA - Internal construct validity: CFA 	N = 1,506 teachers; 543 (36.06%) men Teaching experience <ul style="list-style-type: none"> - 0-3 years: 226 (15.01%) teachers - 4-7 years: 230 (15.27%) teachers - 8-11 years: 190 (12.62%) teachers - 12 or above: 860 (57.10%) teachers Formal teacher leaders: 733 (48.67%) teachers
Study 4	<ul style="list-style-type: none"> - Convergent validity and Discriminate validity: Correlational analysis; CFA - Criterion-related validity: Regression analysis 	N = 1,650 teachers; 575 (34.85%) men Teaching experience <ul style="list-style-type: none"> - 0-3 years: 314 (19.03%) teachers - 4-7 years: 265 (16.05%) teachers - 8-11 years: 193 (11.70%) teachers - 12 or above: 878(53.22%) teachers Formal teacher leaders: 827 (50.12%) teachers

Table 1. Summary of studies, their procedures, and data/sample characteristics

Source(s): Table created by authors

and comprehensibility of all survey items for the broader local and international educational community, we aligned our work with the notion of teachers and school leaders as lifelong learners (OECD, 2019), a teacher competence framework (Education Bureau, 2003), and T-standard+ (The Education Bureau, 2020). The second author subsequently reviewed the adapted items to ensure they accurately reflected the six dimensions of the TEB theoretical framework.

To ensure content validity, we engaged four subject matter experts to review the adequacy and readability of the survey items, ensuring comprehensive coverage of the six dimensions of TEB (Furr, 2011). The reviewers' expertise includes a European researcher specializing in teacher entrepreneurship who is tasked with validating the items against the concept of TEB and incorporating cultural context considerations pertinent to instrument development. A U.S. researcher focused on teacher innovation and entrepreneurship was invited to assess whether the items fall into the conceptual domain and sub-domains of TEB. Moreover, two experienced principals, whose roles are to confirm the items' relevance and applicability within the educational context. This diverse panel ensures that the survey items are scrutinized from multiple perspectives, enhancing the instrument's validity across different cultural and educational settings.

Based on their feedback, we refined the wording of 28 items and split one double-barreled item into two distinct items, resulting in 29 items. The revised pool encompassed the six intended dimensions: coordinating efforts (7 items), seeking resources (4 items), advocating innovation (4 items), ownership-enthusiasm (5 items), risk-taking (5 items), and humility-confidence (4 items).

Study 2: item reduction and construct validity

At the item reduction stage, our objectives were threefold. First, we aimed to provide preliminary evidence of the factor structure of the TEB scale. Second, we sought to reduce the number of items, discarding those that did not fit well, based on low factor loadings. Finally, we aimed to uncover the latent dimensions of TEB, determining the number of factors to extract based on eigenvalues and the interpretability of the factor solution.

Sample. We administered the 29-item survey to 211 teachers drawn from a mix of ten secondary and ten primary schools, all of which have been established for over 20 years (see [Table 1](#) for more details about the sample). All participants had attended a specific leadership development programme designed to enhance their leadership skills. More than half of the respondents held formal leadership roles in their schools, such as department heads. The range of teaching experience among participants was broad, spanning from newly qualified teachers to veterans with decades of experience, ensuring that our data encompassed a wide range of perspectives.

Procedure and results. The study employed a symmetric 6-point Likert scale for measuring agreement, ranging from 1 (Strongly Disagree) to 6 (Strongly Agree), intentionally excluding a midpoint to compel respondents to provide a definitive stance ([Worthington and Whittaker, 2006](#)). Participants were advised to select the box that most accurately reflected their opinion for each question. We conducted an exploratory factor analysis (EFA) (see [Table 2](#)) using an oblique rotation (direct oblimin), which allows for correlations among factors ([Fabrigar et al., 1999](#)). We established the following criteria for the EFA: (1) All items should have regression loadings greater than 0.60 on their intended conceptual factors; (2) Each factor should have three or more conceptually aligned items; and (3) All items should have cross-loadings less than 0.40 on other factors. Evaluation of the scree plot suggested four factors with eigenvalues >1, accounting for approximately 50.68% of the variance characterized by an adequate sample size (Kaiser-Meyer-Olkin = 0.909; Bartlett's test of sphericity $X^2 = 1208.208$, $df = 406$, $p < 0.001$). After applying these criteria, we retained 15 items for the scale.

Several items originally intended for the "Coordinating Efforts" and "Ownership-Enthusiasm" factors were absorbed by other factors. Specifically, one "Ownership-Enthusiasm" item ("I am willing to dedicate my own time and resources to actualizing my initiative") was absorbed by "Advocating Innovation", and another ("My innovation fit my ideal in education") was absorbed by "Risk-Taking". Given these changes, we reconsidered the labels of our factors to better reflect the associated items.

We relabeled "Risk-Taking" as "Mitigating Risk", as the items in this factor suggested that entrepreneurial teachers focus more on anticipating and preventing risks rather than taking them. We also relabeled "Humility-Confidence" as "Cultivating Cohesiveness". This change was made because the items in this factor indicated that entrepreneurial teachers use humility as a strategy to foster cohesiveness and gain support for their initiatives, rather than just demonstrating genuine care and confidence. To ensure the face validity of the revised scale, we invited a subject-matter expert, who was also familiar with the construct development process, to re-evaluate the appropriateness of the new items and labels. This expert agreed with the revised four-factor scale.

Item	Loading	Eigenvalues	Amount of variance explained	Cronbach's alpha
<i>Mitigating risk</i>		3.161	30.049	0.87
1. I regularly modify my initiative to cater for learners' diversity	0.606			
2. I am willing to try regardless of the uncertainty (risk) of the outcomes	0.693			
3. I enhance my colleagues' awareness and understanding in my initiative	0.634			
4. Through explaining my educational ideal, I am confident in persuading my colleagues into cooperation	0.637			
<i>Advocating innovation</i>		2.523	25.281	0.78
5. I am willing to dedicate my own time and resources to actualizing my initiative	0.619			
6. My innovation fit my ideal in education	0.733			
7. I am informed of current education trends and proactively share my own views and give suggestions	0.791			
8. I am a keen advocate of innovative initiatives in schools	0.679			
<i>Cultivating cohesiveness</i>		1.623	13.960	0.82
9. I am humble to listen to my colleagues suggestions	0.762			
10. I care about the individual needs of my colleagues	0.767			
11. I acknowledge the dedication of my colleagues to their work	0.803			
<i>Seeking resources</i>		1.103	12.895	0.84
12. I seek financial assistance to support my initiative	0.655			
13. I promote opportunities for conversation between colleagues and experts from both inside and outside of our school regarding the latest information and practices in particular fields of expertise	0.701			
14. I help my colleagues get professional advice from experts at our school	0.710			
15. I help my colleagues get professional advice from experts outside of our school	0.760			

Table 2.
EFA ($N = 211$)

Source(s): Table created by authors

Study 3: internal consistency and construct validity

Sample. To validate the new four-factor structure of the TEB scale, we administered the revised 15-item survey to a third independent sample. This sample consisted of 1,506 teachers from a blend of 16 secondary and 12 primary schools, all of whom were participants in a leadership training workshop. Participation in the survey was voluntary. The sample was diverse, with 36.03% identifying as male and 48.67% holding formal leadership roles within their schools. Furthermore, the sample covered a broad range of teaching experiences, ensuring an array of perspectives were represented in the data.

Procedure and results. First, we conducted a replication EFA using the Principal Axis Factoring method, with squared multiple correlations on the diagonal (refer to [Table 3](#)).

The criteria were the same as those used in Study 3. The eigenvalue plot showed a steep drop between the first factor (eigenvalue = 7.601) and the fourth factor (eigenvalue = 1.674), suggesting a four-factor solution. All items exhibited strong loadings on their intended factors, all above 0.6, thus supporting the retention of all 15 items. The revised Teacher Entrepreneurial Behavior (TEB) scale showed excellent internal consistency, as indicated by a Cronbach's alpha of 0.93. This result suggests that the TEB construct, as measured by these 15 items, is a coherent construct. The four confirmed factors, along with their associated items, are presented in [Table 3](#).

Second, we conducted a CFA using maximum likelihood estimation to test the model derived from the EFA. This step was crucial as the CFA more effectively detects items with weak loadings and those with strong covariance with other factors. The latter scenario violates the principle of a simple structure, which dictates that items should belong to only one factor. The criteria from the EFA procedure and the CFA model fit index guided our analysis. Additionally, we adhered to the principles of developing the TEB scale. Consequently, all 15 items were retained in the CFA (see [Figure 1](#)). The resulting model fit indices were as follows: Comparative Fit Index (CFI) = 0.973; Incremental Fit Index (IFI) = 0.973; Goodness of Fit Index (GFI) = 0.958; Adjusted Goodness of Fit Index (AGFI) = 0.933; and Root Mean Squared Error of Approximation (RMSEA) = 0.048. These values all meet or exceed the recommended standards (as per [Marsh et al., 2004](#)). The four

Item	Loading	Amount of variance explained	Cronbach's alpha
<i>Advocating innovation</i>		22.97	0.85
1. I proactively share my own views	0.799		
2. I am a keen advocate of innovative initiatives in schools	0.767		
3. I am willing to dedicate my own time and resources to actualizing my initiative	0.731		
4. My innovation fits my ideal in education	0.718		
<i>Seeking resources</i>		17.92	0.89
5. I help my colleagues get professional advice from experts outside of our school	0.788		
6. I promote opportunities for conversation between colleagues and experts from both inside and outside of our school regarding the latest practices in particular fields of expertise	0.817		
7. I seek financial assistance to support my initiative	0.766		
8. I help my colleagues get professional advice from experts at our school	0.755		
<i>Cultivating cohesiveness</i>		16.35	0.80
9. I acknowledge the dedication of my colleagues to their work	0.842		
10. I care about the individual needs of my colleagues	0.617		
11. I humbly listen to my colleagues' suggestions	0.829		
<i>Mitigating risk</i>		15.86	0.85
12. I am willing to try regardless of the uncertainty (risk) of the outcomes	0.626		
13. I regularly modify my initiative	0.608		
14. Through explaining my educational ideal, I am confident in persuading my colleagues into cooperation	0.802		
15. I enhance my colleagues' understanding in my initiative	0.710		

Source(s): Table created by authors

Table 3.
EFA ($N = 1,506$)

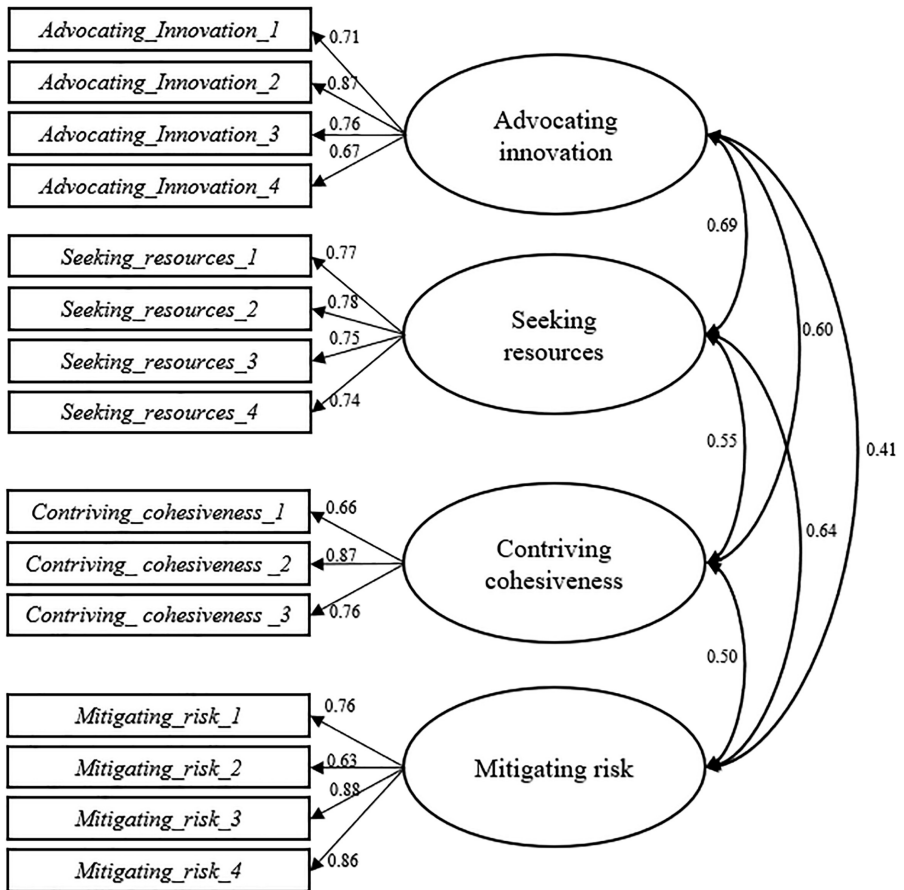


Figure 1.
CFA (N = 1,506)

Source(s): Figure created by authors

original factors remained intact: Advocating Innovation (4 items), Seeking Resources (4 items), Cultivating Cohesiveness (3 items), and Mitigating Risk (4 items).

Third, we conducted an internal consistency analysis. The resulting Cronbach's alpha values ranged from 0.804 to 0.892, with an average value of 0.850. This indicates high reliability for each sub-scale, demonstrating that our model can be meaningfully employed in further analysis (refer to Table 4 for details). Subsequently, we examined the internal construct validity using factor inter-correlations. The correlations ranged from 0.476 to 0.677, suggesting that the four factors of the TEB scale, while distinct, are interrelated constructs. These values, indicating a moderate to strong relationship between the factors, align with our theoretical assumptions about the interconnected nature of the dimensions within TEB. Such results lend support to the internal construct validity of our scale. Moreover, the range of inter-correlation further substantiates the multidimensionality of the TEB scale, while implying that each dimension contributes uniquely to the overall construct. A comparison was drawn between a hypothesized four-factor model (M1), which encompassed advocating innovation, seeking resources, cultivating cohesiveness through humility, and mitigating

risk as unique factors, and three alternative models (M2 – M4), where the items for two factors with relatively higher corrections were loaded on one factor. The comparative analysis revealed that M1 provided superior data fit over the alternative models (RMSEA = 0.058; normed fit index = 0.968; CFI = 0.973; goodness-of-fit index (GFI) = 0.958; chi-square (χ^2) [75] = 458.389, $p < 0.001$), as represented in Table 5. This outcome further underscores the construct validity of the TEB scale. This affirms the complex, interrelated nature of the constructs we are measuring.

Study 4: convergent and discriminant evidence, and predictive validity

This study aimed to establish the convergent and discriminant evidence, and predictive validity of the new TEB scale. Convergent evidence refers to the degree to which two measures of constructs are theoretically related. Discriminant evidence tests whether constructs that are not supposed to be related are actually unrelated. Predictive validity is concerned with predicting subsequent performance or outcomes (Hinkin, 1998). In order to evaluate these forms of validity, we examined the association of the TEB scale with three constructs: innovative practice, job satisfaction, and team trust.

The first construct, innovative practice, is anticipated to share a close relationship with TEB, as both constructs involve elements of creativity, initiative, and the implementation of new ideas or methods (Neto et al., 2019). However, while they share these attributes, they are not identical constructs. Innovative practice involves the creation and application of novel teaching methods or strategies, whereas TEB goes a step further to encompass entrepreneurial aspects such as recognizing opportunities and actualizing innovative practices (Eyal and Yosef-Hassidim, 2012; Ho et al., 2021; Kasim, 2021). The other two constructs, job satisfaction and team trust, are also theoretically connected to TEB. Job satisfaction could have a bidirectional relationship with TEB, as teachers who derive more

TEB scale	Mean (SD)	Cronbach (α)	Factor inter-correlations (r)		
			F2	F3	F4
F1 Advocating innovation	4.419 (0.77)	0.853	0.615**	0.492**	0.677**
F2 Seeking resources	4.122 (0.91)	0.892	–	0.476**	0.623**
F3 Cultivating cohesiveness	4.920 (0.70)	0.804		–	0.634**
F4 Mitigating risk	4.548 (0.71)	0.849			–

Note(s): * $p < 0.05$, ** $p < 0.01$
Source(s): Table created by authors

Table 4.
Descriptive statistics,
Cronbach’s alpha and
factor inter-
correlations
($N = 1,506$)

Model	χ^2	df	P	GFI	CFI	NFI	RMSEA
Four factor model (M ₁)	458.389	75	<0.001	0.958	0.973	0.968	0.058
Three factor model (M ₂)	648.136	78	<0.001	0.942	0.960	0.955	0.070
Three factor model (M ₃)	929.012	78	<0.001	0.908	0.940	0.935	0.085
Three factor model (M ₄)	636.306	78	<0.001	0.943	0.961	0.955	0.069

Note(s): χ^2 , chi-square; df , degrees of freedom; GFI, goodness of fit index; CFI, comparative fit index; NFI, normed fit index; RMSEA, root mean square error of approximation

M₂ is the same as M₁ except items for F1 and F4 are loaded on one factor

M₃ is the same as M₁ except items for F2 and F4 are loaded on one factor

M₄ is the same as M₁ except items for F3 and F4 are loaded on one factor

Source(s): Table created by authors

Table 5.
Model fit summary and
measure models
comparison ($N = 1,506$)

satisfaction from their jobs may be more inclined to take calculated risk for spurring innovations (Kasim, 2021; Neto et al., 2018). Similarly, team trust could influence individual entrepreneurial behavior. Individuals who trust their colleagues may be more willing to take risks and implement innovative ideas, both of which are key aspects of entrepreneurial behavior (Neto et al., 2018). Job satisfaction and intrateam trust create a safe and enabling environment for experimentation and are important for nurturing a sense of community among staff, which is essential for successful school changes (Ho and Man, 2022).

Sample. A survey, encompassing the measures of four variables, was distributed to participants in a teacher leader training program. The survey garnered responses from a total of 1,650 teachers across 18 secondary schools and 16 primary schools. Of these participants, 50.12% held formal teacher leadership roles, and 34.85% identified as male.

Measure. Anderson et al.'s (2002) instrument was used to measure Job satisfaction (4 items; $\alpha = 0.91$; e.g. At the school, subject, or working group where I work, I am treated with respect.). Team trust was assessed using De Jong and Elfring's (2010) instrument (5 items; $\alpha = 0.95$; e.g. I can rely on my team members to keep their word.). Jansen et al.'s (2006) instrument was used to measure innovative practices. (6 items; $\alpha = 0.96$; e.g. I develop and experiments with new teaching and learning strategies).

Procedure and results. The validity of the newly developed TEB scale was examined through measures of convergent and discriminant evidence, utilizing correlation coefficients and Confirmatory Factor Analysis (CFA). Convergent evidence was evaluated through a correlation analysis between the TEB scale and constructs of innovative practice, job satisfaction, and team trust. The observed correlations between the four factors of the TEB scale exceeded 0.70, suggesting a strong relationship among these factors, thereby affirming the convergent evidence of the TEB scale. Discriminant evidence was evaluated through correlation coefficient and CFA. The correlations between the TEB scale and all other variables, which were below 0.50 (See Table 6), suggest a sufficient distinction between the TEB scale and the other constructs. A comparison was drawn between a hypothesized four-factor model (M1), which encompassed advocating innovation, seeking resources, cultivating cohesiveness through humility, and mitigating risk as unique factors, and three alternative models (M2 – M4), where each outcome variable is added as an additional factor for TEB. The comparative analysis revealed that M1 provided superior data fit over the alternative models (RMSEA = 0.047; normed fit index = 0.982; CFI = 0.986; goodness-of-fit index (GFI) = 0.956; chi-square (χ^2) [80] = 664.260, $p < 0.001$), as represented in Table 7. This outcome underscores

Variables	Mean	SD	Cronbach (α)	2	3	4	5	6	7
1. Advocating innovation	4.30	0.80	0.88	0.72**	0.73**	0.71**	0.44**	0.47**	0.37**
2. Seeking resources	4.01	0.94	0.91	–	0.74**	0.76**	0.47**	0.43**	0.37**
3. Cultivating cohesiveness	4.89	0.69	0.81		–	0.77**	0.48**	0.47**	0.44**
4. Mitigating risk	4.47	0.72	0.87			–	0.44**	0.47**	0.49**
5. Innovative practice	4.30	0.78	0.94				–	0.63**	0.65**
6. Job Satisfaction	4.59	0.82	0.90					–	0.68**
7. Team Trust	4.53	0.83	0.94						–

Note(s): * $p < 0.05$, ** $p < 0.01$

Source(s): Table created by authors

Table 6. Means, standard deviations, and correlations of TEB scales to the three additional measures ($N = 1,650$)

the discriminant evidence of the TEB scale, implying that the constructs it measures are distinct and not merely reflections of other variables.

The predictive validity was tested using regression analysis (Table 8) with the measure of job satisfaction, team trust, and innovative practice. Based on the CFA result, Bartlett factor scores yielded unbiased estimates of four-factor score parameters (Jöreskog and Sörbom, 2018). It was expected that TEB would positively predict the three variables. Significant positive relationships were found between TEB and job satisfaction ($\beta = 0.590, p < 0.001$), between TEB and team trust ($\beta = 0.513, p < 0.001$), and between TEB and teacher innovation ($\beta = 0.566, p < 0.001$). This implies there were substantial and meaningful relations between TEB and the above constructs.

Discussion

As global school reform accelerates, TEB becomes increasingly critical to teacher professionalism (Wilkins *et al.*, 2021). It represents a proactive approach towards innovation, continuous improvement, and strategic engagement with new opportunities in education. Teachers who embrace TEB act as catalysts for change, promoting collaboration and a unified vision, and thus cultivate resilient professional communities dedicated to excellence and shared advancement. This section delves into the findings, discussing their implications for theoretical and practical applications in educational settings.

The TEB inventory

The purpose of this research was to develop a new scale for measuring TEB and to demonstrate the utility of TEB as an independent and valid construct in explaining key school management outcomes. We developed and tested multi-dimensional measures of TEB. The resulting 15-item scale was composed of four dimensions, advocating innovation, seeking resources, cultivating cohesiveness through humility, and mitigating risk, presenting an interesting contrast to some findings in the extant literature.

Model	χ^2	<i>df</i>	<i>P</i>	GFI	CFI	NFI	RMSEA
Four factor model (M ₁)	664.260	80	<0.001	0.956	0.986	0.982	0.047
Five factor model (M ₂)	1383.514	131	<0.001	0.876	0.945	0.939	0.073
Five factor model (M ₃)	1350.407	142	<0.005	0.890	0.948	0.942	0.072
Five factor model (M ₄)	2024.176	179	<0.001	0.877	0.932	0.926	0.079

Note(s): χ^2 , chi-square; *df*, degrees of freedom; GFI, goodness of fit index; CFI, comparative fit index; NFI, normed fit index; RMSEA, root mean square error of approximation

M₂ is the same as M₁ except loading job satisfaction

M₃ is the same as M₁ except loading team trust

M₄ is the same as M₁ except loading innovative practices

Source(s): Table created by authors

Table 7.
Model fit summary and
measure models
comparison (*N* = 1,650)

	<i>R</i> ²	Adjusted <i>R</i> ²	<i>F</i>	Standardized coefficient – β
Job satisfaction	0.348	0.348	880.982**	0.590**
Team trust	0.264	0.263	590.155**	0.513**
Teacher innovation	0.320	0.319	774.963**	0.566**

Note(s): Independent Variable: TEB; **p* < 0.005, ***p* < 0.001

Source(s): Table created by authors

Table 8.
Regression
analysis (*N* = 1,650)

From the literature, entrepreneurial teachers spent considerable effort coordinating colleagues, particularly facilitating internal communication and promoting direction, to actualize innovative ideas (Borasi and Finningan, 2010; Weber *et al.*, 2013). However, our results revealed that participants did not perceive coordinating effort as a primary facet of TEB. The results indicate that the essence of TEB lies in the willingness to invest personal time and resources to pilot the innovative initiative, a commitment that participants view as fundamental to promoting and advancing new educational initiatives among their peers and leadership. Furthermore, the result of seeking resources indicated that entrepreneurial teachers prioritize understanding and addressing their colleagues' concerns, connecting with both internal and external sources of expertise to marshal resources, which aligns more with the role of a facilitator. These insights reveal that entrepreneurial teachers perceive a paradigmatic shift from traditional planning and leadership models toward a proactive stance in advocating for innovation, which is characterized by direct and tangible actions. They view innovation in schools not merely as an individual endeavor but as a collective progression, leveraging and expanding their social networks to positively influence teachers and leaders. This approach aims to enhance their colleague's human and social capital and foster an environment where innovative initiatives can thrive through community-wide support.

The literature suggests entrepreneurial teachers take calculated risks with expectations for positive results (Hayat and Amer, 2015; Ho *et al.*, 2021) and demonstrate confidence in convincing colleagues with a humble manner (see Kasim and Zakaria, 2019). However, our results revealed that entrepreneurial teachers go beyond mere risk-taking by proactively mitigating potential resistance from other teachers. They accomplish this by adapting initiatives to address specific concerns. Furthermore, they purposefully and tactfully recognize and leverage teachers' individual strengths and needs, facilitating a collaborative effort. These findings suggest that entrepreneurial teachers embody a viable strategy for the successful implementation of innovative initiatives, predicated on the close collaboration among teachers who respect and acknowledge each other's concerns and contributions. In this context, entrepreneurial teachers cultivate a culture conducive to change that nurtures coherence and reinforces the collective social fabric of school communities.

Validation of the TEB scale

Our results provide support for the four TEB dimensions, with evidence of reliability, content validity, construct validity, and predictive validity over diverse samples. The TEB scale demonstrated high content validity that integrated both theoretical and empirical strategies to ensure they more authentically covered relevant items and content domains from the existing literature and practitioners (see Schriesheim *et al.*, 1993). The TEB scales also had good construct validity. All item loading in the scales was greater than 0.6, and all factor reliabilities were acceptable to excellent, ranging from 0.80 to 0.91. Furthermore, the CFA analyses demonstrated good construct validity of the new four-factor model. The final validation step provides evidence that the TEB scale predicts considerable variance in the three outcome constructs – innovative practice, job satisfaction, and team trust. These findings not only establish the predictive validity of the new TEB scale but also indicate that TEB is valuable in achieving desirable outcomes in schools.

Implications

While the literature has extensively highlighted the importance of TEB (Neto *et al.*, 2019; van Dam *et al.*, 2010), a critical observation needs to be made about the development of prior TEB scales. These scales often lacked a solid theoretical foundation and were at times borrowed from corporate entrepreneurship, without sufficient empirical research to support the adaptation. This has led to less valid measurement of TEB and further hindered the

understanding of how TEB relates to other important constructs and outcomes in educational settings. The lack of agreement and conceptual confusion characterizes the current competency-based frameworks and instruments used to measure TEB. By leveraging a systematic review and a well-conceptualized study (Ho *et al.*, 2021), this study endeavors to rectify these inconsistencies prevalent in the field.

Research implication. This study is critical and timely to provide a scale to measure TEB further clarifies the latent structure of the TEB construct. As an important first step, this study augments our comprehension of the nature of TEB but also examines its potential effects in nurturing collaborative communities among teachers within schools (Ho and Man, 2022). Despite the breadth of the intended construct, the scale is relatively short (15 items) and can be readily incorporated into survey research. The application of the TEB scale in forthcoming research endeavors is anticipated to substantially enhance our conceptual grasp of the antecedents, the essence, and the ramifications of TEB.

Theoretical implication. The relationship between TEB and the drive for teacher professionalism is closely intertwined. Teacher professionalism is characterized by a dedication to ongoing betterment, a commitment to lifelong education, and an unwavering adherence to elevated professional standards (Wilkins *et al.*, 2021). Entrepreneurial behaviors emerge as a pivotal conduit for educators to showcase and augment their professional stature. By providing a means to assess TEB, the scale enables scholars to identify the factors contributing to teacher professionalism, which is important for redefining the concept of teacher professionalism through educational entrepreneurship. Moreover, cultivating a community of innovative teachers is essential for fostering an environment where entrepreneurial behaviors are valued and encouraged (Davis, 2023). The TEB scale does more than just illuminate entrepreneurial teachers' entrepreneurial characteristics and practices; it also acts as an indicator of fostering a community of innovative teachers. It contributes valuable insights into the collective impact of entrepreneurial teachers on the progression and evolution of schools.

Practical implication. This study has practical implications for school teachers, school leaders, teacher educators, and education policymakers. Entrepreneurial teachers are central to fostering a culture of innovation and shared professional development within schools, a cornerstone of teacher professionalism (Ho and Man, 2022). To capitalize on the findings of this research, a self-assessment rubric could be developed based on the TEB scale. This rubric would serve multiple purposes across various levels of the education system. Teachers can use the rubric as a self-assessment tool to identify their current entrepreneurial competencies and areas for growth. For school leaders, the rubric provides a framework to mentor and support their staff in developing entrepreneurial skills. It allows them to recognize and celebrate entrepreneurial behavior amongst teachers, fostering a school-wide culture of innovation. Teacher educators can utilize the rubric within teacher preparation programs to instill entrepreneurial mindsets in future educators. For policymakers, the rubric could serve as a strategic tool to set benchmarks for entrepreneurial competencies across the education sector. It aids the formulation of policies that promote innovation in teaching and learning. Collectively, this strategic focus on entrepreneurial skills empowers teacher leaders to navigate and influence complex educational reforms, reinforcing their role as drivers of progress and stewards of a professional learning community within their schools (Davis, 2023).

Limitation and future directions

Although the current study demonstrates satisfactory measurement qualities of the new TEB scale, some limitations of our study need to be acknowledged. First, all the measures in the present research were self-reported, which may have created biases by common-method variance. To minimize potential biases in future studies, we suggest inviting different

stakeholders who closely work with entrepreneurial teachers to complete the survey that assesses entrepreneurial teachers. Second, the current study utilizes a sample consisting solely of teachers in Hong Kong, which raises an important question regarding the cross-cultural applicability of the TEB scale. Hong Kong's hybrid cultural landscape, shaped by a history of British colonial rule interwoven with Chinese cultural values and sovereignty, may provide a special context for exploring the instrument. In particular, Hong Kong society reputedly reflects a high collectivistic culture (Hofstede, 1980), where organizational members emphasize independence and value loyalty to the group, which might underlie the salience of cultivating cohesiveness in Hong Kong context. However, Hui (1988) and many more recent studies found Hong Kong respondents were becoming more individualistic, and the global promotion of collaborative professionalism and teamwork (Hargreaves and O'Connor, 2018) may engender more need for cultivating cohesiveness elsewhere. With this said, it is important to recognize that scale validation is not a one-time event but a continuous process. A must begin with empirical validation in a specific cultural context and then can be extended to additional contexts (AERA *et al.*, 2014). Indeed, Hong Kong could present a very appropriate setting for the initial validation of the TEB scale. For instance, Hong Kong schools represents a small, yet steadily performing education system which aligns well with contemporary global trends in educational reforms. Future research should aim to extend the survey to different cultural settings to evaluate the scale's generalizability. This approach would contribute significantly to the body of knowledge by confirming whether the TEB construct, as currently conceptualized and measured, possesses cross-cultural validity, a crucial aspect of educational and psychological.

References

- American Educational Research Association, American Psychological Association, and National Council on Measurement in Education (2014), *Standards for Educational and Psychological Testing*, AERA, Washington, DC.
- Anderson, S.E., Coffey, B.S. and Byerly, R.T. (2002), "Formal organizational initiatives and informal workplace practices: links to work-family conflict and job-related outcomes", *Journal of Management*, Vol. 28 No. 6, pp. 787-810, doi: [10.1177/014920630202800605](https://doi.org/10.1177/014920630202800605).
- Borasi, R. and Finnigan, K. (2010), "Entrepreneurial attitudes and behaviors that can help prepare successful change-agents in education", *The New Educator*, Vol. 6 No. 1, pp. 1-29, doi: [10.1080/1547688x.2010.10399586](https://doi.org/10.1080/1547688x.2010.10399586).
- Chand, V.S. (2014), "Socio-educational entrepreneurship within the public sector: leveraging teacher-driven innovations for improvement", in *International Educational Innovation and Public Sector Entrepreneurship*, Emerald Group Publishing, Vol. 23, pp. 59-82.
- Chawla, S. and Lenka, U. (2015), "A study on learning organizations in Indian higher educational institutes", *Journal of Workplace Learning*, Vol. 27 No. 2, pp. 142-161, doi: [10.1108/jwl-07-2014-0052](https://doi.org/10.1108/jwl-07-2014-0052).
- Davis, J. (2023), *How to Become an Entrepreneurial Teacher: Being Innovative, Leading Change*, Routledge.
- De Jong, B.A. and Elfring, T. (2010), "How does trust affect the performance of ongoing teams? The mediating role of reflexivity, monitoring, and effort", *Academy of Management Journal*, Vol. 53 No. 3, pp. 535-549, doi: [10.5465/amj.2010.51468649](https://doi.org/10.5465/amj.2010.51468649).
- Education Bureau (2003), "Towards a learning profession: the teacher competencies framework and the continuing professional development of teachers", available at: <http://www.edb.gov.hk/en/teacher/qualification-training-development/development/cpd-teachers/index.html> (assessed 30 September 2017).

- Eyal, O. and Inbar, D.E. (2003), "Developing a public-school entrepreneurship inventory: theoretical conceptualization and empirical examination", *International Journal of Entrepreneurial Behavior and Research*, Vol. 9 No. 6, pp. 221-244, doi: [10.1108/13552550310501356](https://doi.org/10.1108/13552550310501356).
- Eyal, O. and Yarm, M. (2018), "Schools in cross-sector alliances: what do schools seek in partnerships?", *Educational Administration Quarterly*, Vol. 54 No. 4, pp. 648-688, doi: [10.1177/0013161x18765268](https://doi.org/10.1177/0013161x18765268).
- Eyal, O. and Yosef-Hassidim, D. (2012), "Managing educational champions: entrepreneurship in schools", *Journal of School Leadership*, Vol. 22 No. 1, pp. 210-255, doi: [10.1177/105268461202200109](https://doi.org/10.1177/105268461202200109).
- Fabrigar, L.R., Wegener, D.T., MacCallum, R.C. and Strahan, E.J. (1999), "Evaluation of the use of exploratory factor analysis in psychological research", *Psychological Methods*, Vol. 4 No. 3, pp. 272-299, doi: [10.1037//1082-989x.4.3.272](https://doi.org/10.1037//1082-989x.4.3.272).
- Furr, M. (2011), *Scale Construction and Psychometrics for Social and Personality Psychology*, SAGE, New York.
- Hanson, J. (2017), "Exploring relationships between K-12 music educators' demographics, perceptions of intrapreneuring, and motivation at work", *Journal of Research in Music Education*, Vol. 65 No. 3, pp. 309-327.
- Hargreaves, A. (2022), "High school change: a reflective essay on three decades of frustration, struggle and progress", *Journal of Educational Administration*, Vol. 60 No. 3, pp. 245-261, doi: [10.1108/jea-01-2022-0013](https://doi.org/10.1108/jea-01-2022-0013).
- Hargreaves, A. and O'Connor, M.T. (2018), *Collaborative Professionalism: when Teaching Together Means Learning for All*, Corwin Press, London.
- Hargreaves, A. and Shirley, D. (2020), "Leading from the middle: its nature, origins and importance", *Journal of Professional Capital and Community*, Vol. 5 No. 1, pp. 92-114, doi: [10.1108/jpcc-06-2019-0013](https://doi.org/10.1108/jpcc-06-2019-0013).
- Hargreaves, A. and Shirley, D. (2021), "Leadership, identity, and intersectionality", in *Future Alternatives for Educational Leadership*, Routledge, pp. 111-125.
- Hayat, N. and Amer, I. (2015), "Entrepreneurial orientation – a key to unlock teacher's potential in higher education: a case of Finland and Pakistan", *Revista Romaneasca Pentru Educatie Multidimensionala*, Vol. 7 No. 2, pp. 67-77, doi: [10.18662/rrem/2015.0702.06](https://doi.org/10.18662/rrem/2015.0702.06).
- Hejazi, S.A.M., Malei, M.M. and Naeiji, M.J. (2012), "Designing a scale for measuring entrepreneurial leadership in SMEs", *International Conference on Economics, Marketing and Management, IPEDR*, Vol. 28 No. 2, pp. 71-77.
- Hinkin, T.R. (1998), "A brief tutorial on the development of measures for use in survey questionnaires", *Organizational Research Methods*, Vol. 1 No. 1, pp. 104-121, doi: [10.1177/109442819800100106](https://doi.org/10.1177/109442819800100106).
- Ho, C.S.M. (2023), "Unpacking the principal strategies in leveraging weighted student funding", *Sustainability*, Vol. 15 No. 16, 12592, doi: [10.3390/su151612592](https://doi.org/10.3390/su151612592).
- Ho, C.S.M. and Man, T.W.Y. (2022), "The conditions of opportunity recognition in schools: an investigation of how entrepreneurial teachers discover new educational opportunities", *Journal of Professional Capital and Community*, Vol. 7 No. 2, pp. 109-125, doi: [10.1108/jpcc-04-2021-0022](https://doi.org/10.1108/jpcc-04-2021-0022).
- Ho, C.S.M., Lu, J. and Bryant, D.A. (2020), "The impact of teacher entrepreneurial behaviour: a timely investigation of an emerging phenomenon", *Journal of Educational Administration*, Vol. 58 No. 6, pp. 697-712, doi: [10.1108/jea-08-2019-0140](https://doi.org/10.1108/jea-08-2019-0140).
- Ho, C.S.M., Lu, J. and Bryant, D.A. (2021), "Understanding teacher entrepreneurial behavior in schools: conceptualization and empirical investigation", *Journal of Educational Change*, Vol. 22 No. 4, pp. 1-30, doi: [10.1007/s10833-020-09406-y](https://doi.org/10.1007/s10833-020-09406-y).
- Hofstede, G. (1980), *Culture's Consequences: International Differences in Work-Related Values*, Sage, Beverly Hills, CA.

- Hui, C.H. (1988), "Measurement of individualism-collectivism", *Journal of Research in Personality*, Vol. 22 No. 1, pp. 17-36, doi: [10.1016/0092-6566\(88\)90022-0](https://doi.org/10.1016/0092-6566(88)90022-0).
- Jansen, J.J., Van Den Bosch, F.A. and Volberda, H.W. (2006), "Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators", *Management Science*, Vol. 52 No. 11, pp. 1661-1674, doi: [10.1287/mnsc.1060.0576](https://doi.org/10.1287/mnsc.1060.0576).
- Joensuu-Salo, S., Peltonen, K., Hämäläinen, M., Oikkonen, E. and Raappana, A. (2020), "Entrepreneurial teachers do make a difference – or do they?", *Industry and Higher Education*, Vol. 35 No. 4, pp. 536-546, doi: [10.1177/0950422220983236](https://doi.org/10.1177/0950422220983236).
- Jöreskog, K.G. and Sörbom, D. (2018), "*LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*", *Scientific software international*.
- Juwita, R. (2019), "Investigating initial competencies of primary school teachers in the principal preparation program", *International Conference Primary Education Research Pivotal Literature and Research UNNES 2018 (IC PEOPLE UNNES 2018)*, Atlantis Press, Kyoto, pp. 103-106.
- Kasim, N.M. (2021), "The influence of entrepreneurial leadership and sustainability leadership on high-performing school leaders: mediated by empowerment", *Leadership, Education, Personality: An Interdisciplinary Journal*, Vol. 3 No. 2, pp. 101-115.
- Kasim, N.M. and Zakaria, M.N. (2019), "The significance of entrepreneurial leadership and sustainability leadership (leadership 4.0) towards Malaysian school performance", *International Journal of Entrepreneurship*, Vol. 2 No. 8, pp. 27-47, doi: [10.35631/ijemp.28003](https://doi.org/10.35631/ijemp.28003).
- Keyhani, N. and Kim, M.S. (2020), "A systematic literature review of teacher entrepreneurship", *Entrepreneurship Education and Pedagogy*, Vol. 4 No. 3, pp. 376-395, doi: [10.1177/2515127420917355](https://doi.org/10.1177/2515127420917355).
- Kurniawan, J.E., Suhariadi, F. and Hadi, C. (2017), "The impact of school's corporate cultures on teacher's entrepreneurial orientation: the mediating role of readiness for change", *Expert Journal of Business and Management*, Vol. 5 No. 1, pp. 22-31.
- Marsh, H.W., Hau, K.T. and Wen, Z. (2004), "In search of golden rules: comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings", *Structural Equation Modeling*, Vol. 11 No. 3, pp. 320-341, doi: [10.1207/s15328007sem1103_2](https://doi.org/10.1207/s15328007sem1103_2).
- Martin, A.M., Abd-Ei-Khalick, F., Mustari, E. and Price, R. (2018), "Effectual reasoning and innovation among entrepreneurial science teacher leaders: a correlational study", *Research in Science Education*, Vol. 48 No. 6, pp. 1297-1319, doi: [10.1007/s11165-016-9603-1](https://doi.org/10.1007/s11165-016-9603-1).
- McGee, J.E., Peterson, M., Mueller, S.L. and Sequeira, J.M. (2009), "Entrepreneurial self-efficacy: refining the measure", *Entrepreneurship Theory and Practice*, Vol. 33 No. 4, pp. 965-988.
- Messick, S. (1995), "Validity of psychological assessment: validation of inferences from persons' responses and performances as scientific inquiry into score meaning", *American Psychologist*, Vol. 50 No. 9, pp. 741-749, doi: [10.1037//0003-066x.50.9.741](https://doi.org/10.1037//0003-066x.50.9.741).
- Neto, R.D.C.A., Rodrigues, V.P. and Panzer, S. (2017), "Exploring the relationship between entrepreneurial behavior and teachers' job satisfaction", *Teaching and Teacher Education*, Vol. 63, pp. 254-262, doi: [10.1016/j.tate.2017.01.001](https://doi.org/10.1016/j.tate.2017.01.001).
- Neto, R.C.A., Rodrigues, V.P., Stewart, D., Xiao, A. and Snyder, J. (2018), "The influence of self-efficacy on entrepreneurial behavior among K-12 teachers", *Teaching and Teacher Education*, Vol. 72, pp. 44-53, doi: [10.1016/j.tate.2018.02.012](https://doi.org/10.1016/j.tate.2018.02.012).
- Neto, R., Rodrigues, V.P., Polega, M. and Persons, M. (2019), "Career adaptability and entrepreneurial behaviour in the K-12 classroom", *Teachers and Teaching*, Vol. 25 No. 1, pp. 90-109, doi: [10.1080/13540602.2018.1526783](https://doi.org/10.1080/13540602.2018.1526783).
- Neto, R.A., Rodrigues, V.P. and Lusinchi, D. (2020), "Entrepreneurial behavior scale: a validation study", *Revista@ Mbianteeducação*, Vol. 13 No. 2, pp. 27-46, doi: [10.26843/ae19828632v13n22020p27a46](https://doi.org/10.26843/ae19828632v13n22020p27a46).

- OECD (2019), *TALIS 2018 Results (Volume I) Teachers and School Leaders as Lifelong Learners*, OECD, London.
- Oplatka, I. (2014), "Understanding teacher entrepreneurship in the globalized society: some lessons from self-starter Israeli school teachers in road safety education", *Journal of Enterprising Communities*, Vol. 8 No. 1, pp. 20-33, doi: [10.1108/jec-06-2013-0016](https://doi.org/10.1108/jec-06-2013-0016).
- Ponterotto, J.G. and Ruckdeschel, D.E. (2007), "An overview of coefficient alpha and a reliability matrix for estimating adequacy of internal consistency coefficients with psychological research measures", *Perceptual and Motor Skills*, Vol. 105 No. 3, pp. 997-1014.
- Raudenbush, S.W. (2004), "*HLM 6: Hierarchical Linear and Nonlinear Modeling*", *Scientific Software International*.
- Schriesheim, C.A., Powers, K.J., Scandura, T.A., Gardiner, C.C. and Lankau, M.J. (1993), "Improving construct measurement in management research: comments and a quantitative approach for assessing the theoretical content adequacy of paper-and-pencil survey-type instruments", *Journal of Management*, Vol. 19 No. 2, pp. 385-417, doi: [10.1177/014920639301900208](https://doi.org/10.1177/014920639301900208).
- Schyns, B. and Von Collani, G. (2002), "A new occupational self-efficacy scale and its relation to personality constructs and organizational variables", *European Journal of Work and Organizational Psychology*, Vol. 11 No. 2, pp. 219-241, doi: [10.1080/13594320244000148](https://doi.org/10.1080/13594320244000148).
- Stone-Johnson, C. (2017), "Autonomy, professionalism, and the role of generation in professional capital", *Journal of Professional Capital and Community*, Vol. 2 No. 1, pp. 18-35, doi: [10.1108/jpc-10-2016-0024](https://doi.org/10.1108/jpc-10-2016-0024).
- Strom, P.S., Strom, R.D. and Moore, E.G. (1999), "Peer and self-evaluation of teamwork skills", *Journal of Adolescence*, Vol. 22 No. 4, pp. 539-553, doi: [10.1006/jado.1999.0247](https://doi.org/10.1006/jado.1999.0247).
- The Education Bureau (2020), "*Education Bureau circular no. 6/2020 implementation of the recommendations of the task force on professional development of teachers.*" The Education Bureau, June 10, available at: <https://www.edb.gov.hk/attachment/en/teacher/qualificationtraining-development/development/cpd-teachers/EDBC20006E.pdf>
- Tierney, P. and Farmer, S.M. (2004), "The pygmalion process and employee creativity", *Journal of Management*, Vol. 30 No. 3, pp. 413-432.
- Tul, M., Leskošek, B. and Kovač, M. (2019), "The professional competencies of physical education teachers from North-Eastern Italy", *Center for Educational Policy Studies Journal*, Vol. 9 No. 1, pp. 103-120.
- Van Dam, K., Schipper, M. and Runhaar, P. (2010), "Developing a competency-based framework for teachers' entrepreneurial behavior", *Teaching and Teacher Education*, Vol. 26 No. 4, pp. 965-971, doi: [10.1016/j.tate.2009.10.038](https://doi.org/10.1016/j.tate.2009.10.038).
- Weber, S., Trost, S., Wiethe-Körprich, M. and Achtenhagen, F. (2013), "Development of intrapreneurship-behavior at commercial workplaces", *Annual Meeting of the AERA*, San Francisco.
- Wilkins, C., Gobby, B. and Keddie, A. (2021), "The neo-performative teacher: school reform, entrepreneurialism and the pursuit of educational equity", *British Journal of Educational Studies*, Vol. 69 No. 1, pp. 27-45, doi: [10.1080/00071005.2020.1739621](https://doi.org/10.1080/00071005.2020.1739621).
- Worthington, R.L. and Whittaker, T.A. (2006), "Scale development research: a content analysis and recommendations for best practices", *The Counseling Psychologist*, Vol. 34 No. 6, pp. 806-838, doi: [10.1177/0011000006288127](https://doi.org/10.1177/0011000006288127).

Further reading

- Ho, C.S.M. and Bryant, D.A. (2023), "Entrepreneurial teacher leaders as reframers of pastoral care: the mediating influence of technological opportunism", *Asia Pacific Journal of Education*, pp. 1-17, doi: [10.1080/02188791.2023.2292965](https://doi.org/10.1080/02188791.2023.2292965).

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Author	Purpose of study	Source of measures (journal and author)	TEB dimensions	Example of scales
Van Dam, Schipper and Runhaar (2010)	Investigate the competencies that underlie TEB	Developed a scale by reviewing business literature	- Opportunity recognition - Initiative - Risk management (Employ 18 items)	“The past year at work. I took initiative, even when others did not.” “I have sufficient knowledge about developments in the market.”
Chawla and Lenka (2015)	Study the antecedents and consequences of learning organizations in Indian higher educational institutes	Unknown	- Intrapreneurship (Employed nine items)	“Our institute facilitates us to develop institute’s R&D centers.” “Our institute encourages us to adopt innovative methods in teaching and research.”
Kurniawan <i>et al.</i> (2017)	Examine the role of corporate cultures in schools toward teacher’s entrepreneurial orientation with teacher’s readiness for change as a mediator	Developed a scale by reviewing business literature	- Innovativeness - Proactiveness - Risk-taking (Employ 19 items)	“I am implementing a more creative new teaching method in the classroom.”
Hanson (2017)	Examine how entrepreneurial behaviors relate to teachers’ workplace motivation and demographics	Entrepreneurship Theory and Practice – McGee <i>et al.</i> (2009)	- Self-efficacy (Employ 19 items)	“Identify opportunities to develop new teaching methods and/or ensembles.”
Neto <i>et al.</i> (2017)	Explore the relationship between entrepreneurial behavior and job satisfaction among teachers	Teaching and Teacher Education – Van Dam <i>et al.</i> (2010)	- Opportunity recognition - Initiative - Risk management (Employed 17 items)	“I took initiative, even when others did not.” “I usually was the last one to learn about upcoming changes.”
Neto <i>et al.</i> (2018)	Assess the unique contributions of self-efficacy to entrepreneurial behavior among teachers, and identify the demographic characteristics associated with entrepreneurial behavior	Teaching and Teacher Education – Van Dam <i>et al.</i> (2010)	- Opportunity recognition - Initiative - Risk management (Employed 13 items)	“I actually implemented plans I had made.”

Table A1.
TEB measures
employed in studies

(continued)

Author	Purpose of study	Source of measures (journal and author)	TEB dimensions	Example of scales
Martin et al. (2018)	Examine the effectual reasoning of educational entrepreneur in K-12 public school	Developed scales by reviewing effectual reasoning literature	<ul style="list-style-type: none"> - Affordable loss - Strategic partnerships - Spontaneity - Planning - Perception of risk - Collaborative - Creativity - View of the future (Employ 31 items) 	<p>“My peers usually join me in my innovations because of the way I am able to describe the vision.”</p> <p>“One of the reasons I like to implement innovation is because I like doing something that no one else has ever done before.”</p>
Neto et al. (2019)	Test a predictive model of entrepreneurial behavior, and identified differences between highly and minimally entrepreneurial teachers on how and why they adapt their teaching practices	Teaching and Teacher Education – Van Dam et al. (2010)	<ul style="list-style-type: none"> - Opportunity recognition - Initiative - Risk management (Employed 14 items) 	<p>“I kept a close eye on new developments in the educational field.”</p> <p>“I usually waited to see how things worked out.”</p>
Tul et al. (2019)	Examine the moderating effect of entrepreneurial spirit on teacher professional competence	Developed a scale by reviewing physical education literature	<ul style="list-style-type: none"> - Organization and entrepreneurial spirit (Employ four items) 	<p>“Ability to take initiative, entrepreneurial spirit”</p> <p>“Ability for formation and leading various projects”</p>
Kasim and Zakaria (2019)	Examines the entrepreneurial leadership among the headmasters and principals in schools in improving the performance of schools in Malaysia	Journal of Management – Tierney and Farmer (2004) International Conference on Economics, Marketing and Management – Hejazi et al. (2012)	<ul style="list-style-type: none"> - Creative - Risk-taking - Proactive - Innovative - Strategic - Communicative - Motivational - Personal (Employ 53 items) 	<p>“Predicting future problems and crises”</p> <p>“Showing empathy to others”</p> <p>“Open mind in dealing with events”</p>
Neto et al. (2020)	Assess the reliability and validity of entrepreneurial behavior	Developed a scale by revising Van Dam et al.’s (2010) questionnaire	<ul style="list-style-type: none"> - Opportunity - Risk - Initiative (Employ 14 items) 	<p>“I usually waited to see how things worked out.”</p> <p>“I usually was the last one to learn about upcoming changes.”</p>

Source(s): Table created by authors

Table A1.